

Understanding the exposure of climate hazards on Māori-owned businesses



Summary

This study examines the exposure of climate hazards on Māori-owned businesses, highlighting regions and industries that may be particularly exposed now and, in the future. It explores in more detail the top three industries where most Māori-owned businesses operate.

Whakatauki

Tē tōia, tē haumatia
Not dragged, not shouted.

Nothing can be achieved without a plan, a workforce and a way of doing things.

The whakatauki is a metaphor based on the traditional method of launching a large canoe.

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Section 1. Executive Summary

Our study examines the exposure of climate hazards on Māori-owned businesses,¹ highlighting regions and industries that may be particularly exposed now and, in the future.

It explores in more detail the top three industries where most Māori-owned businesses operate:

1. Construction
2. Agriculture, Forestry and Fishing
3. Professional, Scientific, and Technical Services.

Together, these sectors constitute 56% of Māori-owned businesses.

Purpose

This study is a first step analysis to understand the risks and opportunities for Māori-owned businesses in relation to climate change, with the ultimate goal of establishing a knowledge base that informs Te Puni Kōkiri about the support required by Māori-owned businesses to enhance their resilience to climate change. Additionally, it aims to contribute to a knowledge base that guides government and Māori (businesses, whānau, hapu, and iwi) decisions for future resilience.

Insights and Learnings

We wanted to investigate how climate hazards may affect Māori businesses, examining factors like business counts, employee numbers, wages and sales.

¹ Two definitions of a Māori-owned business were employed to create our dataset. However, for this insights report, a Māori-owned business is defined as one with at least

Through the study, it was clear that primary sector or agriculture-related sectors (where Māori businesses are concentrated), consistently show high vulnerability.

Regional variations of exposure to current and future climate hazards are outlined, with Northland highlighted as particularly susceptible.

The following table provides a summary of key business statistics for Māori and non-Māori owned businesses in 2020.

Table 1: Summary of key business statistics for Māori in 2020

Key business demographics	Māori owned	Non-Māori owned	Ratio of Māori to non-Māori
Business (count)	30,354	256,380	0.12
Employees (head count)	83,910	767,050	0.11
Sales (\$M)	10,851	108,623	0.10
Wages (\$M)	1,315	13,774	0.10

Methodology

Combining climate hazard data from the National Institute of Water and Atmospheric Research (NIWA) and business data from the Longitudinal Business Database (LBD) and Integrated Data Infrastructure (IDI), the study identifies industries exposed to climate hazards.

We used data from the 2020 tax year to mitigate the impact of COVID-19 on the data.

We examined both baseline and future climatology values. In this report, the term 'current' refers to the baseline period (1986-2005

one owner identifying as Māori and having non-zero income from self-employment in 2020. Refer to page 18 for a more in-depth discussion on this.



average), while 'future' pertains to the projected changes by mid-century (2031-2050 average). For flooding, we used all available historic data in 2021 and the corresponding modelling results by NIWA. For sea-level rise, 0.5 m rise was chosen to span the plausible extremes over 2031-2050 period.

We set specific thresholds for the seven climate hazards, following a similar approach to our earlier study on how hapori Māori face climate risks. If a hazard's current and projected measurements exceed the threshold for that climate hazard, we consider the area as exposed, affected or at risk.

We looked at how Māori-owned businesses are exposed to seven climate hazards now and into the future.

These are:

- Sea level rise:** Areas susceptible to inundation at extreme coastal sea levels with no sea level rise (baseline) and a future projection of 50cm sea level rise based on the 1% Annual Exceedance Probability.
- Wet spells:** Number of days per year with rainfall exceeding 1mm for five or more consecutive days.
- Heatwave days:** Number of days per year where maximum temperature exceeds 25°C for three or more consecutive days.
- Extreme hot days:** Number of days per year with maximum temperatures exceeding 30°C.
- Drought:** Probability of potential evapotranspiration deficit (PED) exceeding 200mm.
- Extreme rainfall:** Number of days per year with rainfall greater than 30mm.
- Flooding:** Areas prone to flooding.

All business information was summarised into broad geographic areas to protect confidentiality, using regional council areas where possible. In some cases, adjacent regional councils were grouped together for reporting. For instance, the West Coast regional council was grouped with Taranaki and Whanganui councils due to similar climate conditions rather than with its neighbouring councils in the South Island.

Refer to pages 38-44 for a detailed discussion of the methodology used.

Recommendations

The findings from this study, when considered alongside other factors that drive business composition and performance in an area or region - like how many people live there, what the land is like, how easy it is to get to infrastructure, what resources are available, and how much businesses rely on local suppliers – could provide some insight into potential options for businesses that may be forced to exit or transform in the face of a changing climate.

While policy recommendations are not included in this data and insights report, we plan to collaborate with our policy teams at Te Puni Kōkiri and external stakeholders to develop next steps, other relevant insights reports and data products (eg labour productivity, characteristics of industries and firms that inform risks, more detailed look into risks and opportunities for Māori-owned businesses) and provide relevant policy implications and recommendations.



Section 2. Key Findings

Here are the key findings from this initial study, looking at various aspects like industry, climate risks, specific regions, and other important discoveries. Unless specified, these key findings pertain to Māori-owned businesses.

2.1 Industry Highlights

Our study found:

- Māori business counts in 2020 are concentrated in key industries – Construction, Agriculture, Forestry and Fishing, and Professional, Scientific, and Technical Services.
 - **Construction:** Over a quarter (28%) of Māori-owned businesses in construction sector are based in Auckland.
 - **Agriculture, Forestry and Fishing:** Māori-owned businesses in these sectors are highly represented in areas with abundant with abundant agricultural land/whenua such in Taranaki/Whanganui/West Coast (32%), Otago/Southland (31%), Northland (29%), Gisborne/Hawke's Bay (27%) and Waikato (26%).
 - **Professional, Scientific, and Technical Services:** The greatest number of Māori-owned businesses in this sector are in Auckland (1,596), while 25% of Māori-businesses in this sector are in Wellington.
- Over half (56%) of Māori-owned businesses operate in these top three industries, with the majority being construction.
- Auckland has the highest number of Māori-owned (7,551), mirroring the national trend. This is followed by Waikato with 4,062 Māori-owned businesses and then Bay of Plenty with 3,093 Māori-owned businesses.

- The top three Māori industries employ more than half (54%) of the workforce (including working proprietors).
- Māori-owned businesses are relatively small, with the average number of workers across all sectors being 2.76 workers (including working proprietors). In the top three industries, Māori-owned businesses have an average of 2.65 workers (including working proprietors).
- Accommodation and Food Service, Retail Trade, and Manufacturing have the highest number of employees (including working proprietors) per business, at 5.9, 5.1, and 3.8 workers, respectively.
- In 2020, Māori-owned businesses paid \$1.32 billion wages, with Construction, and Agriculture, Forestry and Fishing leading in total wage spend.
- Māori-owned businesses contributed \$10.85 billion in sales to the NZ economy in 2020.

2.2 Climate Hazards Highlights

Our initial investigation into the connection between present-day characteristics and performance of Māori-owned businesses and climate hazards reveal several important insights.

“Māori-owned businesses encounter a range of climate hazards, with exposure levels differing among industries and regions.”



2.2.1 Climate Hazards and their Key Impacts on Sectors and Regions

We examined both baseline and future climatology values. In this report, the term 'current' refers to the baseline period (1986-2005 average), while 'future' pertains to the projected changes by mid-century (2031-2050 average).

Flooding

- Māori-owned businesses in the Agriculture, Forestry, and Fishing industries are in areas that are most exposed to current flooding hazards, followed by Construction, then Professional, Scientific, and Technical Services.
- Northland (74%), Tasman/Nelson/Marlborough (52%) and Auckland (52%) have the highest levels of exposure to current flooding, with over half of Māori-owned businesses remaining exposed even with a 5% meshblock flooding threshold².

Sea Level Rise

- Across all industries, Accommodation and Food Services, Agriculture, Forestry, and Fishing, and Wholesale Trade are the most exposed to coastal inundation due to sea level rise.
- Bay of Plenty, Northland and Auckland regions have the highest number of businesses exposed to sea level rise.

Extreme Hot Days

- Currently, 7% of Māori-owned businesses face extreme hot days. This is projected to increase to 17% in the future, with Agriculture, Forestry, and Fishing being the most exposed industries.

- The most exposed industry to extreme hot days in terms of absolute number is Construction (1,239), and in terms of percentage, Accommodation and Food Services, at 20%.
- Canterbury (1,716 businesses affected), Otago/Southland (267 businesses affected), and Gisborne/Hawke's Bay (132 businesses affected) currently face extreme hot days.

Heatwave Days

- Currently, 13% of Māori-owned businesses are exposed to heatwave days, projected to increase to 68% in the future, affecting all industries.
- In Northland, Māori-owned businesses are likely to be significantly affected by heatwaves, with an anticipated increase of 84 percentage points.
- Auckland is the region that will experience the most increase from baseline to future, at 94% (from 0%-94% of businesses affected).

Drought

- The proportion of Māori-owned businesses exposed to drought is expected to rise from 9% to 27% in the future.
- In the Gisborne and Hawke's Bay regions, 77% of Māori-owned businesses are currently exposed to drought. This figure is projected to rise to 99% of Māori-owned businesses exposed in the future.
- Canterbury is the region that will experience the most increase from baseline to future, at 63% (from 16% to 79%).

Extreme Rainfall

- Currently, 14% of Māori-owned businesses face extreme rainfall, expected to slightly increase in the future, with Agriculture, Forestry, and Fishing being the most exposed industry. This is true in terms of

² We have used two thresholds in assessing if a Māori business in a region is affected by flooding or coastal inundation due to sea level rise – 1) any flooding of the meshblock, and 2) 5% of the meshblock is flooded. Meshblocks are small geographic units used for the collection and dissemination of statistical

data in New Zealand, typically representing areas that are easily identifiable by residents and have well-defined boundaries.



the absolute number and, also, the percentage of exposed businesses.

- Māori-owned businesses in Northland are most at risk from extreme rainfall, currently at 58%. However, this is expected to decrease by 11 percentage points to 47% Māori-owned businesses exposed in the future.
- Bay of Plenty is the region that is projected to experience the most increase, at 12% (from 38% to 50% of businesses exposed).

Wet Spell Days

- The number of wet spell days is anticipated to decrease, with Agriculture, Forestry, and Fishing being the most exposed Māori-owned businesses.
- Currently, Māori-owned businesses in Taranaki, Whanganui, and the West Coast experience the highest risk of wet spells at 44%. Northland follows at 18%, and Waikato at 13%. In the future, these regions are expected to continue facing relatively high exposure to wet spells compared to others, even though there will be fewer days with wet spells overall in these areas.

2.3 Regional Highlights

The following findings present an overview on how Māori-owned businesses in the regions are exposed to climate hazards, revealing current and future challenges such as flooding, rising sea levels, extreme hot days, heatwaves, drought, extreme rainfall, and wet spells.

Notably, Māori-owned businesses in Northland face the highest current exposure to flooding.

Regional highlights include:

- Every region currently experiences flooding, with Māori-owned businesses in Northland facing the most exposure.
- In the future, Māori-owned businesses in Northland, the Bay of Plenty, and Gisborne/Hawke's Bay will have the most businesses affected by rising sea levels.
- Māori-owned businesses in Canterbury are expected to have the highest exposure to extreme hot days in the future, followed by Gisborne/Hawke's Bay.
- Māori-owned businesses in all regions will face increased heatwaves in future, with Gisborne/Hawke's Bay, Northland, Auckland, and Waikato expecting significant exposure, ranging from 92%-99% exposure.
- Gisborne/Hawke's Bay and Tasman/Nelson/Marlborough regions will face the highest future exposure to drought, both with 79% of Māori-owned businesses projected to be exposed.
- Māori-owned businesses in Bay of Plenty and Northland will encounter the most extreme rainfall in the future.
- The combined regions of Taranaki/Whanganui/West Coast are projected to have the highest exposure of Māori-owned businesses to wet spells in the future.

Māori-owned businesses in Northland have the greatest number of climate hazards with higher-than-average exposure in the future.

Wellington has no Māori-owned businesses with above-average exposure to climate hazards in the future.



The study also highlighted regions in which Māori-owned businesses face high, medium (mid) or low exposure to different climate hazards in the future compared to the overall average risk ranking.³

Table 2 summarises the level of exposure of Māori-owned businesses to these climate hazards in the future, excluding flooding, which was only assessed for the present day and not the future. Flooding and sea level rise use 5% threshold and other hazards used 90th percentile threshold.

The summary table displays the relative risk ranking of regions in comparison to others. A "low" designation indicates a risk level lower than the overall average. Please refer to Table 5 on page 29 for the detailed percentage of Māori businesses exposed to different climate hazards.

Table 2: Summary Table on Level of Exposure of Māori-owned Businesses to Climate Hazards

Region	Flooding in current day	Sea level rise in future	Extreme hot days in future	Heatwaves in future	Drought in future	Extreme rainfall in future	Wet spell days in future
Northland	High	High	Low	High	Low	High	Mid
Auckland	Mid	Low	Low	High	Low	Low	Low
Waikato	Mid	Low	Low	High	Low	Mid	Mid
Bay of Plenty	Mid	High	Low	Mid	Mid	High	Low
Gisborne/ Hawke's Bay	Low	High	High	High	High	Low	Low
Taranaki/ Whanganui/ West Coast	Low	Low	Low	Low	Mid	Mid	High
Wellington	Low	Low	Low	Low	Mid	Low	Low
Tasman/ Nelson/ Marlborough	Mid	Mid	Mid	Low	High	Mid	Low
Canterbury	Mid	Mid	High	Mid	High	Low	Low
Otago/ Southland	Low	Low	Mid	Low	Mid	Low	Mid

Source: Dataset released from the Stats NZ IDI research

³ We applied the **k-means clustering algorithm** to partition the regions into three groups: **Low**, **Mid**, and **High**. These groups correspond progressively to higher risk levels for each respective climate hazard.



We have performed supplementary analysis to evaluate the potential impact of diverse climate hazards in each region on the top three industries with the greatest concentration of Māori-owned businesses. We examined the relative risk rankings across regions and identified the highest proportion of affected businesses. Specific proportions of businesses exposed are detailed in tabular form on pages 29, 32, 33 and 34 of this report.

Construction

We looked at how Māori-owned Construction businesses in each region might be affected by the seven different climate hazards. Key highlights:

- **Northland:** Has the highest proportion of Māori-owned businesses exposed to current day flooding at 69%, and it also leads in exposure to future extreme rainfall at 46%, surpassing other regions. as well as extreme rainfall in the future (46%) compared to other regions. Additionally, it ranks second in terms of the proportion of Māori-owned businesses exposed to future heatwaves.
- **Gisborne/Hawke's Bay:** In the future, Māori-owned construction businesses in these combined regions are anticipated to have the highest exposure to coastal inundation due to rising sea levels at 21%, heatwaves at 100%, and drought at 98%. Moreover, it ranks second in terms of exposure to extreme hot days at 91% compared to all regions.
- **Taranaki/Whanganui/West Coast:** Stands out as the region most vulnerable to future wet spell days, with 38% of Māori-owned businesses exposed. In contrast, all other regions show considerably lower exposure, ranging from only 1% to 8%.
- **Wellington:** The sole region where Māori-owned businesses exhibit below-average exposure to all climate hazards.
- **Canterbury:** Has the highest percentage of Māori-owned businesses exposed to future extreme hot days at 96%, and it ranks second with an 85% exposure to future drought among Māori-owned businesses.
- **Otago/Southland:** Exposure to wet spells is mid-range, and all others is below average.

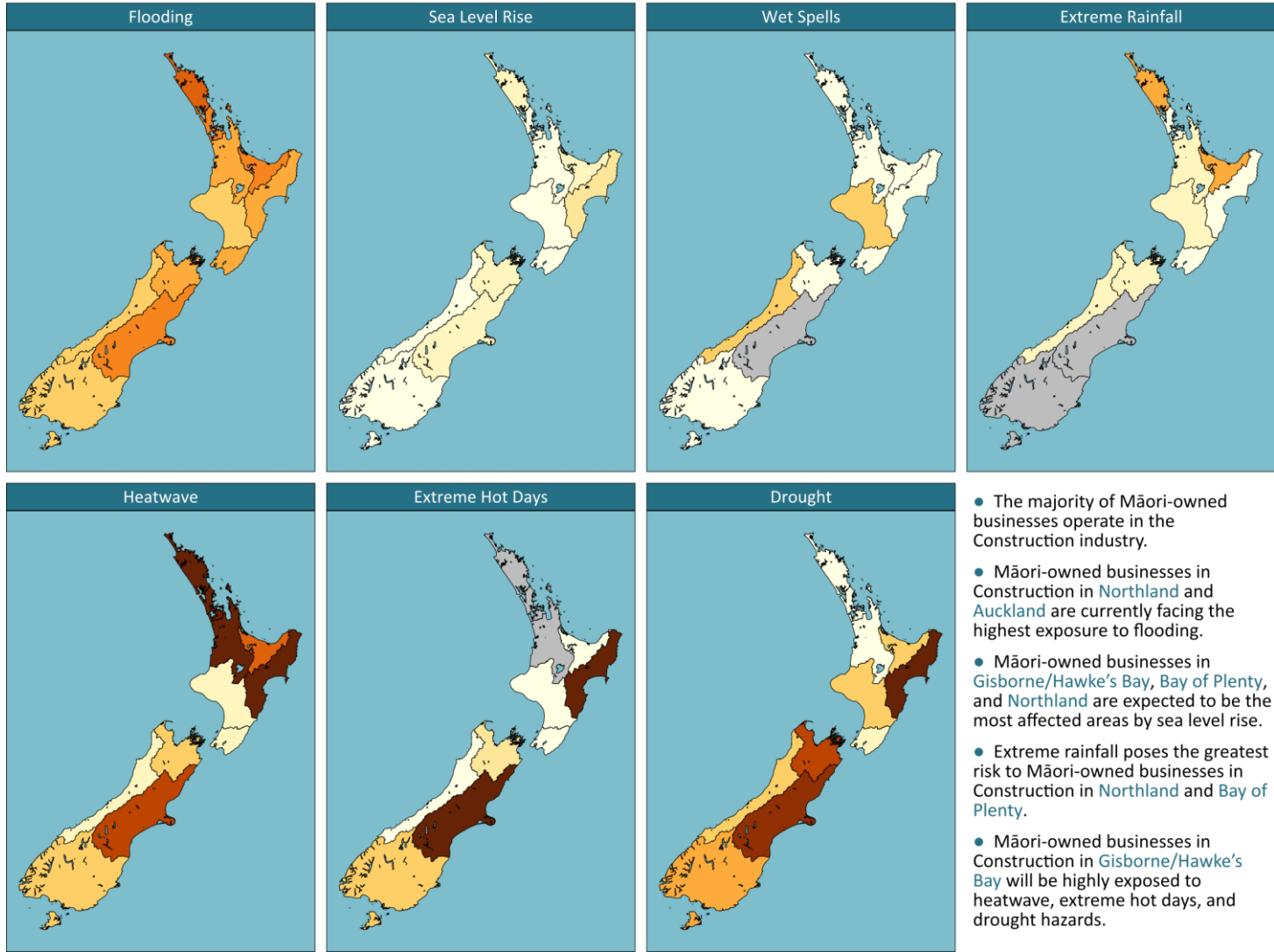
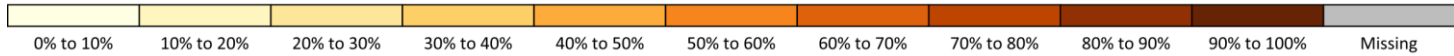


This is Kat from (Ruatōria based) Tairāwhiti Contracting who successfully secured a government procurement contract to repair the cyclone-ravaged East Coast State Highway 35 with another contractor.



MAP A: How Māori-owned Construction Businesses Are Exposed to Selected Climate Hazards

% of Exposed Māori-Owned Businesses in Construction



- The majority of Māori-owned businesses operate in the Construction industry.
- Māori-owned businesses in Construction in **Northland** and **Auckland** are currently facing the highest exposure to flooding.
- Māori-owned businesses in **Gisborne/Hawke's Bay**, **Bay of Plenty**, and **Northland** are expected to be the most affected areas by sea level rise.
- Extreme rainfall poses the greatest risk to Māori-owned businesses in Construction in **Northland** and **Bay of Plenty**.
- Māori-owned businesses in Construction in **Gisborne/Hawke's Bay** will be highly exposed to heatwave, extreme hot days, and drought hazards.



Agriculture, Forestry, and Fishing

Māori-owned businesses in Agriculture, Forestry, and Fishing face diverse climate risks. Key highlights:

- **Northland:** Ranks second highest among regions regarding proportion of Māori-owned businesses exposed to various climate hazards. These hazards include current-day flooding (79%), coastal inundation from rising sea levels (20%), future heatwaves (95%), extreme rainfall (50%), and wet spells (26%).
- **Auckland:** Holds the highest percentage of Māori-owned businesses exposed to current-day flooding at 85% and secures the second position in exposure to coastal inundation from rising sea levels, affecting 19% of Māori-owned businesses.
- **Waikato:** Takes the third position, with a significant proportion of Māori-owned businesses, at 93%, exposed to future heatwave days.
- **Bay of Plenty:** In the future, exhibits the highest percentage of Māori-owned businesses exposed to coastal inundation due to sea level rise, at 26%, and it also ranks highest for exposure to extreme rainfall at 81%.
- **Gisborne/Hawke's Bay:** In the future, holds the highest percentage of Māori-owned businesses exposed to heatwaves at 96% and ranks highest for exposure to drought at 95%. This region is projected to be the second most exposed to extreme hot days, at 73% of Māori-owned businesses exposed.
- **Taranaki/Whanganui/West Coast:** Holds the highest percentage of Māori-owned businesses exposed to wet spell days in the future, standing at 43%.
- **Wellington:** Ranks third in terms of the percentage of Māori-owned businesses exposed to extreme at 38% and drought at 60% in the future.
- **Tasman/Nelson/Marlborough:** Holds the second rank for the proportion of Māori-owned businesses exposed to future drought at 77%. Also, it ranks third for proportion of Māori-owned businesses

exposed to current-day flooding at 65% and future extreme rainfall at 33%.

- **Canterbury:** Secures the top rank in the future for the proportion of Māori-owned businesses exposed to extreme hot days, standing at 85%.

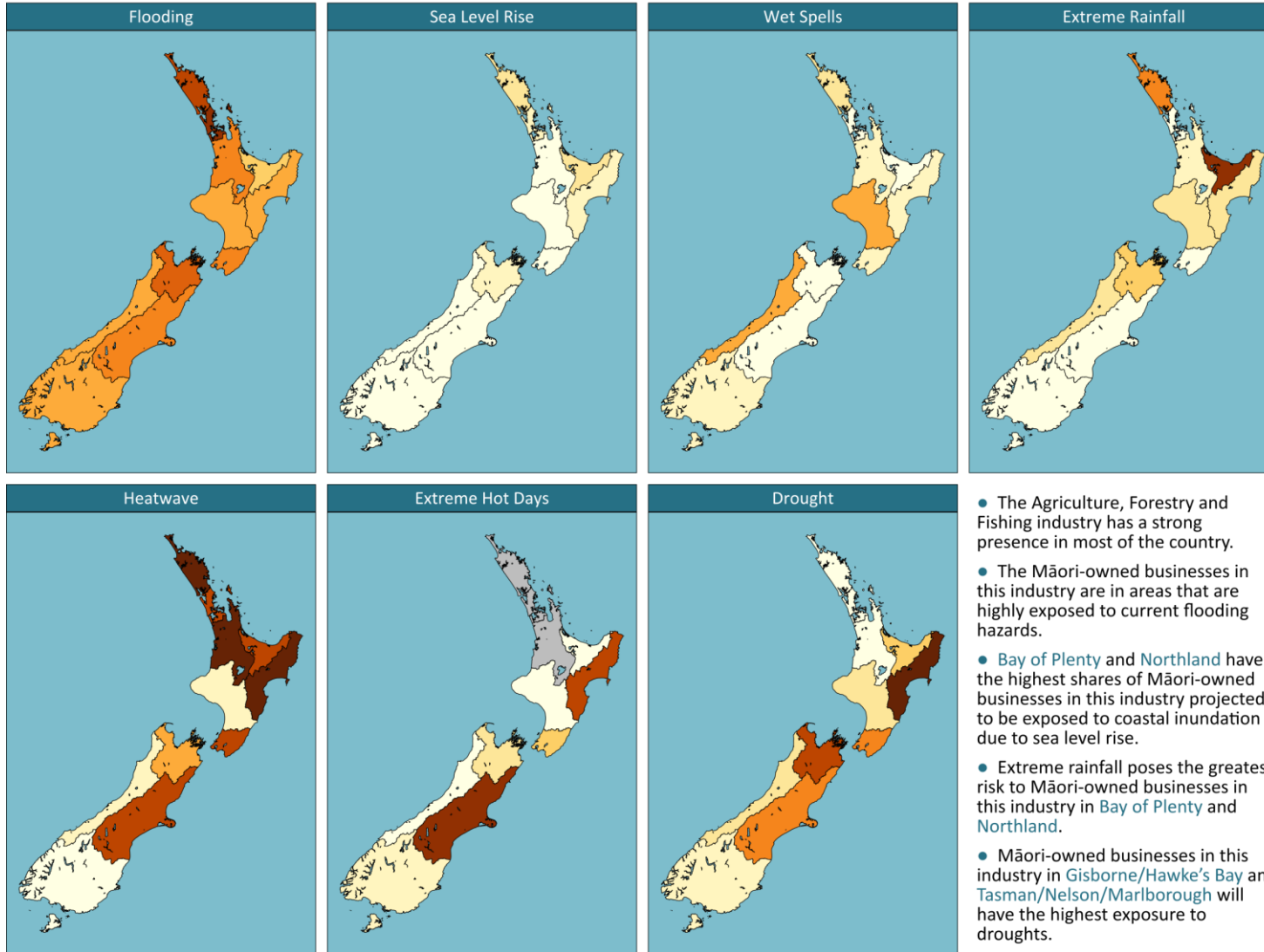


Wi Pere Finishing Farm, adjacent to the Waipaoa awa about 20 kilometres north of Gisborne, had over half of its 870 hectares inundated with sediment and debris when the Waipaoa stop bank broke in the wake of Cyclone Gabrielle in February 2023.



MAP B: How Māori-owned Businesses in Agriculture, Forestry and Fishing Are Exposed to Selected Climate Hazards

% of Exposed Māori-Owned Businesses in Agriculture, Forestry and Fishing



Professional, Scientific, and Technical Services

The Professional, Scientific, and Technical Services industry varies from the other top three climate-vulnerable industries for Māori as it is mostly office-based, and therefore, the effect may not be as pronounced. Key highlights:

- **Northland:** Has the highest proportion of Māori-owned businesses exposed to current day flooding (75%), coastal inundation due to sea level rise (21%), and extreme rainfall (45%). Additionally, it has the second-highest proportion of Māori businesses exposed to heatwaves in the future (99%).
- **Auckland:** Ranks third in the proportion of Māori-owned businesses exposed to heatwaves in the future, at 97%.
- **Bay of Plenty:** Has the highest proportion of Māori-owned businesses exposed to coastal inundation due to sea level rise (21%), ranks second for extreme rainfall (38%), and is tied for third place with Canterbury in terms of current day flooding (49%).
- **Gisborne/Hawke's Bay:** Takes the lead in the proportion of Māori-owned businesses exposed to future heatwaves (100%), and drought (100%). It also ties with Canterbury for the proportion of Māori-owned businesses exposed to future extreme hot days (97%).
- **Taranaki/Whanganui/West Coast:** Stands out as the region most susceptible to future wet spell days, with 38% of Māori-owned businesses exposed, while other regions exhibit lower exposure ranging 2% to 7%.
- **Wellington:** The sole region where Māori-owned businesses exhibit below-average exposure to all climate hazards.
- **Tasman/Nelson/Marlborough:** Ranks first for the proportion of Māori businesses exposed to drought in the future, at 32%.
- **Canterbury:** Ties for first place with Gisborne/Hawke's Bay regions for the highest proportion of Māori-owned businesses exposed to extreme hot days (97%). Additionally, it is ranks second in exposure to future drought at 90%.

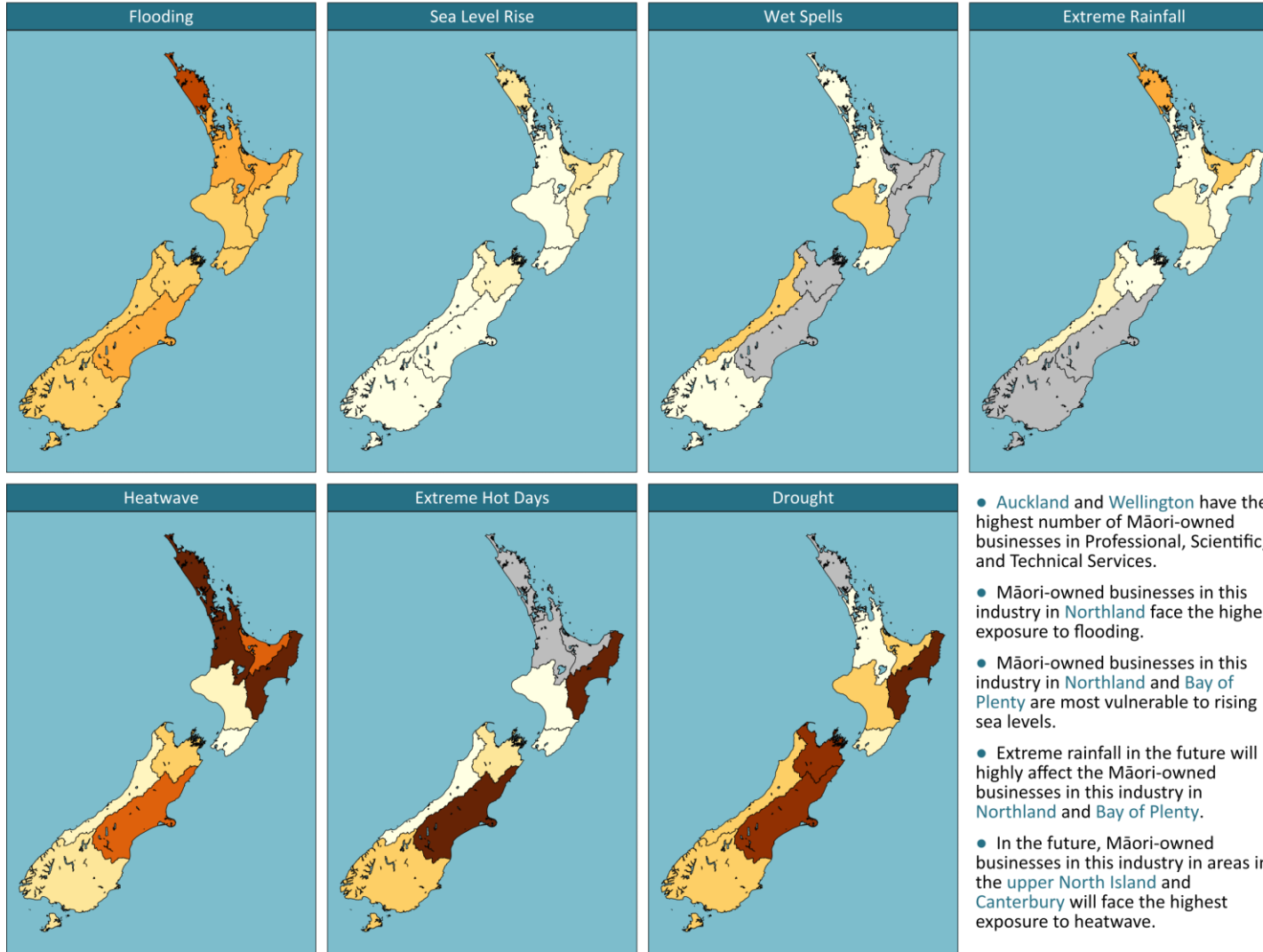
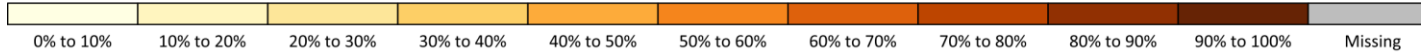


Source: Ministry for the Environment



MAP C: How Māori-owned Businesses in Professional, Scientific and Technical Services Are Exposed to Selected Climate Hazards

% of Exposed Māori-Owned Businesses in Professional, Scientific and Technical Services



- Auckland and Wellington have the highest number of Māori-owned businesses in Professional, Scientific, and Technical Services.
- Māori-owned businesses in this industry in Northland face the highest exposure to flooding.
- Māori-owned businesses in this industry in Northland and Bay of Plenty are most vulnerable to rising sea levels.
- Extreme rainfall in the future will highly affect the Māori-owned businesses in this industry in Northland and Bay of Plenty.
- In the future, Māori-owned businesses in this industry in areas in the upper North Island and Canterbury will face the highest exposure to heatwave.



Section 3. Introduction

Aotearoa New Zealand is exposed to a wide range of natural hazards such as earthquakes, volcanic eruptions, erosion, landslides, and extreme weather events.

Climate change is set to amplify the severity and frequency of some of these hazards, including flooding, heatwaves, drought, and wildfires.

Moreover, it will introduce new hazards stemming from slow-onset changes such as rising sea levels, warming oceans, an increase in hot days, and altered rainfall patterns, with some regions experiencing increased precipitation and others experiencing decreased rainfall.

Changing climatic conditions are expected to have a significant negative impact on the natural assets of the Māori economy. A 2021 study⁴ commissioned by Ngā Pae o te Māramatanga found that:

- More than two thirds (68%) of all Māori-owned businesses are in the primary sector, which is likely to be severely affected by climate change. Large areas of Māori land are already experiencing high rates of erosion.
- Over 80% of Māori land is hilly or mountainous and is susceptible to landslides, which are likely to be exacerbated by extreme rainfall events associated with climate change.
- Māori own 40% of commercial forestry plantations, which are vulnerable to climate extremes such as high-intensity storms, droughts, and wildfires. More frequent severe droughts are likely to have a major impact on Māori forestry, farming, and horticulture operations, particularly in eastern and northern New Zealand.

⁴ Landcare Research prepared the 2021 research report: entitled: *He huringa āhuarangi, he huringa ao a changing climate, a changing world* for Ngā Pae o te Māramatanga – the Māori Centre of Research Excellence based at the University of Auckland.

- Māori also own a third of quota by volume in the fisheries sector. Nearly half of this quota is for potentially at-risk species such as pāua, kōura, and hoki.

In 2022, Te Puni Kōkiri embarked on an initial exploratory analysis to understand the projected climate hazard risk faced by Māori households and communities. By scrutinising the exposure of Māori households to projected climate hazards within the context of their current socio-economic circumstances, this exploratory research yielded a preliminary understanding of Māori communities' ability to cope with, recover from, and adapt to climate change. The previous study⁵ served as the forerunner to this study of Māori business exposure to climate change.



Source Damaged bridge in the Hawke's Bay after Cyclone Gabrielle, February 2023. Photo courtesy of NZ Herald.

⁵ Te Puni Kōkiri released an insights report for policy makers on understanding climate hazards for Hapori Māori. <https://www.tpk.govt.nz/en/mo-te-puni-kokiri/our-stories-and-media/understanding-climate-hazards-for-hapori-maori>.



Section 4. Objectives of the Study

This exploratory analysis will help us better understand risks and opportunities for Māori-owned businesses in the face of climate change.

The ultimate objective of this project is to establish a knowledge base that informs Te Puni Kōkiri about the support required by Māori-owned businesses, and a wider conversation about this kaupapa, to enhance their resilience to climate change. Additionally, it aims to contribute to a knowledge base that guides government and Māori (businesses, whānau, hapu, and iwi) decisions for future resilience.

The study aimed to:

- examine the spatial distribution of Māori-owned businesses alongside baseline and future climate hazards across New Zealand,
- explore the relationship between current-day Māori business characteristics and performance measures and exposure to climate hazards,
- use this information to help identify potential risks and opportunities associated with climate change for Māori-owned businesses, so that they can develop appropriate strategies, such as divesting risky assets and adopting new production systems and practices.

Iwi and hapū

Iwi and hapū are kaitiaki, leaders and decision-makers. Iwi and hapū can help build resilience in their communities and play a strategic role in developing our low-emissions pathway.

- Care for water, native forests and biodiversity as taonga
- Help to create a freight and supply chain strategy, to provide a climate-resilient infrastructure network for Aotearoa
- Help to decarbonise regional transport, energy, and building and construction by making decisions about land use and place-making in our planning system
- Engage in waste and circular economy programmes that better reflect te ao Māori, including the development of a circular economy and bioeconomy strategy
- Ensure their rohe is climate resilient, and their asset base is able to navigate climate risks successfully

Whānau Māori

Whānau, especially community whānau, such as urban marae, kapa haka and whānau kōhanga and kura, are at the centre of community-based initiatives for transitioning to our low-emissions future.

- Create low-emissions community-based transport projects
- Create community waste projects to help people reduce, reuse and recycle
- Demonstrate leadership by practising kaitiakitanga at home, on the papakāinga and marae
- Develop skills for our low-emission future

Māori landowners

Māori own and manage significant land holdings as agricultural, forestry and development land. They can make a contribution to our emission reduction targets while supporting the Māori and Aotearoa New Zealand economies through export earnings.

- Manage forestry to store carbon and provide biomass as an alternative to fossil fuels
- Manage agricultural land to capture value from low-emissions, sustainable food production
- Contribute to our low-emissions energy needs

Māori enterprises

Māori enterprises are vital to the Māori economy and for ensuring the economic rangatiratanga and wellbeing of whānau Māori. Māori small-to-medium enterprises are an increasingly visible part of the broader national economy.

- Work with government and private sector networks to help deliver a successful transition to a low-emission economy
- Create new low-emissions, sustainable services and products, or improve existing ones

Source: Ministry for the Environment

Section 5. Methodology

We combined climate hazard data from NIWA and business data from LBD and IDI to identify industries exposed to climate hazards.

We used a method that combined climate hazard information from the National Institute of Water and Atmospheric Research (NIWA) with business data from the Longitudinal Business Database (LBD) and the Integrated Data Infrastructure (IDI). This helped us pinpoint businesses and industries most affected by current and future climate risks.

The climate hazard data covered various threats like rising sea levels, floods, heatwaves, extreme hot days, droughts, wet spells, and heavy rainfall. Business data included details on business counts, employees, wages, sales, and labour productivity.

We set specific thresholds for each climate hazard, following a similar approach to our earlier study on how hapori Māori face climate risks. If a hazard's current and projected measurements exceed the threshold for that climate hazard, we consider the area as exposed, affected or at risk.

We gathered data for all thresholds and added them to our database. For this report, we've focused on a specific threshold - the 90th percentile of the baseline climatology (1986-2005) value – to share insights.

We used regional council areas where possible, but in areas with low business numbers, especially when examining specific climate risks, we grouped adjacent regional councils or those with similar climate conditions. For a detailed explanation of the method, refer to pages 38-44 in this report.

Māori-owned business definition

In this exploratory analysis, we considered only some types of businesses. Statistics NZ uses a statistical definition for a 'business' that includes institutional units that generally correspond to the types of legal entities operating in New Zealand. A business can be a company, partnership, trust, estate, incorporated society, producer board, local or central government organisation, voluntary organisation or self-employed individual (i.e. individual proprietorship). However, in this analysis, for the purposes of identifying a Māori owned business and for constructing an analysis dataset, only individual proprietors, partnerships, and companies are considered. Excluded industries were Mining, Electricity, Gas, Water and Waste Services, and Public Administration and Safety because the numbers are low and had to be suppressed.

In this exploratory analysis, we used two definitions of a Māori-owned business to create the dataset for analysis.

1. A business with at least one owner who identifies as Māori by ethnicity and/or descent and had non-zero income from self-employment in 2020 (this definition includes sole proprietors)
2. A business with either:
 - A sole proprietorship owned by a Māori person with non-zero income from self-employment in 2020.
 - A company or partnership where at least 50% of the income paid to directors, partners, or active shareholders in 2020 was associated with Māori who identify as Māori by ethnicity and/or descent.

The insights presented in this report used the first definition (which includes sole proprietors with non-zero income in 2020). Note that the approach used in this analysis differs from that used in Te Matapaeroa 2021⁶, where the business population does not include sole traders; sole traders are reported on separately.

⁶ Te Matapaeroa is Te Puni Kōkiri's data and insights series about Māori-owned businesses, Māori sole traders and significant employers of Māori. Te Matapaeroa 2021 is the third iteration in this series. For the recent report, see <https://www.tpk.govt.nz/en/o-matou-mohiotanga/maori-enterprise/te-matapaeroa-2021>.



Section 6. Landscape: Industry focus and regional impact

6.1 Context

This section explores the dynamics of Māori-owned businesses in New Zealand, focusing on their presence in key industries like Construction, Agriculture, Forestry, and Fishing, as well as Professional, Scientific, and Technical Services.

Additionally, this section provides an overview of the number of businesses, their employment figures, wages, sales, and geographic distribution. Sole traders are included in our counts, provided they had some income (non-zero income) in the 2020 tax year. We consulted with the Te Matapaeora 2021 team and study to maintain consistency in our approach, although there are some differences due to the distinct purposes of our reports. For instance:

- We used data from the 2020 tax year to mitigate the impact of COVID-19 on the data. Te Matapaeora 2021 study provides longitudinal analysis from 2001-2021.
- We combined sole traders with non-zero income to capture the overall picture. Te Matapaeora 2021 reports on sole traders and Māori-owned businesses separately.
- We combined regions with small numbers to account for the impact of climate hazards, allowing us to release information from the IDI.
- We have excluded Mining, Electricity, Gas, Water and Waste Services, and Public Administration and Safety from the analysis due to their very low numbers.

6.2 Key Findings

6.2.1 Business Counts

We found that:

- Construction is the most common industry for Māori-owned businesses, followed by Agriculture, Forestry, and Fishing, then Professional, Scientific, and Technical Services.
- More than half (56%) of Māori-owned businesses operate in these top three industries.
- The proportion of Māori-owned businesses varies widely across industries, ranging from 1% or less to 24%. For example, there are six times more Māori-owned Construction businesses than Māori-owned retail trade businesses.
- Of the industries included in the analysis, Māori-owned businesses in Financial and Insurance Services, Information, Media, and Telecommunications, and Education and Training account for only about 1% of all Māori-owned businesses. These industries are less exposed to climate hazards.
- The representation of Māori-owned businesses varies significantly across the country in Construction, Agriculture, Forestry, and Fishing, and Professional, Scientific, and Technical Services. In other industries, the difference is no more than three percentage points.
- Both Māori and non-Māori-owned businesses are most concentrated in Auckland.
- Māori-owned businesses represent a higher percentage of the total businesses in Northland (21%), Bay of Plenty (16%), Gisborne/Hawke's Bay (16%), Waikato (14%), Taranaki/Whanganui/West Coast (12%).

- Auckland has the largest number of Māori-owned businesses (7,551), followed by Waikato (4,062) and Bay of Plenty (3,093).

6.2.2 Workers, Wages and Sales

The patterns in employee counts (workers), wages, and sales mirror the findings in the number of businesses. This section of the report will present some highlights and insights about all employees, including working proprietors, in Māori-owned businesses.

By controlling for the overall size of each industry, we will explore which industries and regions have higher or lower employee numbers, wages, and sales per business.

Workers

More than half of employees (including working proprietors) of Māori-owned businesses are concentrated in the top three sectors, and there are detailed differences in worker numbers, types of businesses, and where they are located.

We found that:

- Māori individuals are employed across a diverse range of industries, encompassing 16 sectors analysed in the study⁷. The cumulative employees (including working proprietors) in these industries amounts to 83,910 individuals.
- More than half (54%) of the total employees (including working proprietors) are concentrated in the top three industries. This underscores the significance of these sectors in providing employment opportunities for Māori workers.
- The average number of workers per Māori-owned business stands at 2.76, slightly lower than the non-Māori average of 2.99. This

distinction may indicate variations in business structures, firm size and workforce management strategies.

- Accommodation and Food Services, Retail Trade, and Manufacturing emerge as the industries with the highest number of employees per business, with figures of 5.86, 5.10, and 3.84, respectively. This points to a concentration of Māori employment in these sectors.
- Māori-owned businesses in Agriculture, Forestry, and Fishing, as well as Professional, Scientific, and Technical Services, have a higher number of workers per business compared to non-Māori-owned businesses. However, in the Construction industry, Māori-owned businesses employ fewer workers per business than non-Māori-owned businesses.
- Auckland, Waikato, and Bay of Plenty are the top three regions with the highest number of workers, accounting for 23%, 14%, and 10% of total workers, respectively.
- Auckland and Wellington have the highest proportion of workers employed in Construction (23%), while Otago/Southland takes the lead in Agriculture, Forestry, and Fishing employment (33%).

Wages

Māori-owned businesses paid \$1.32 billion in wages to employees in 2020.

We found that:

- In 2020, Māori-owned businesses collectively paid out \$1.32 billion in wages, reflecting the economic significance of these enterprises.
- Over half (55%) of the total wages paid by Māori-owned businesses are concentrated in the Construction, Agriculture, Forestry, and Fishing, and Professional, Scientific, and Technical Services industries. This highlights the pivotal role these sectors play in driving income for workers employed in Māori-owned businesses.

⁷ Excluded industries were Mining, Electricity, Gas, Water and Waste Services, and Public Administration and Safety because the numbers are low and had to be suppressed.



- In the top two industries - Construction and Agriculture, Forestry, and Fishing - Māori businesses account for 27% and 17% of the total wages paid, respectively. This is higher than their non-Māori counterparts, which account for 19% and 11% of the total wages paid in these industries, respectively.
- When examining wages per business, Māori-owned businesses generally pay less than non-Māori counterparts across most industries. This could be attributed to factors such as a higher prevalence of working-proprietor-only firms, firms employing fewer people or comparatively lower wages for employees.
- Half of all wages earned by employees (including working proprietors) in the Construction industry come from three regions: Auckland, Waikato and Wellington.
- About half (48%) of total wages for Agriculture, Forestry, and Fishing come from three regions - Waikato, Taranaki/Whanganui/West Coast and Otago/Southland, indicating significant economic contributions in these areas.
- Māori-owned businesses in Tasman/Nelson/Marlborough regions pay higher wages to their employees compared to non-Māori-owned businesses in those regions.

Māori Business Sales

In 2020, Māori-owned businesses contributed \$10.85 billion in sales to NZ economy.

Māori-owned businesses play a vital role in New Zealand's economy. Key industries such as Construction, Agriculture, Forestry, and Fishing, and Professional, Scientific, and Technical Services lead this economic contribution. Auckland leads in Māori business sales, making up 24%, with other significant regions including Waikato (13%), Bay of Plenty (10%), Canterbury (10%), Taranaki/Whanganui/West Coast (9%), and Otago/Southland (9%).

We found that:

- Māori-owned businesses play a significant role in bolstering the New Zealand economy, collectively generating an annual sales figure of \$10.85 billion. The Construction, Agriculture, Forestry, and Fishing, along with Professional, Scientific, and Technical Services industries, emerge as the primary contributors to this economic impact.
- The combined total sales from Financial and Insurance Services, Education and Training, and Information, Media, and Telecommunications account for just 2% of sales for both Māori and non-Māori-owned businesses.
- In the list of regions where Māori-owned businesses make the most sales, Auckland is at the forefront, contributing \$2.64 billion, which is 24% of the total Māori sales. After Auckland, the top five regions are Waikato, Bay of Plenty, Canterbury, and a tie between Taranaki/Whanganui/West Coast and Otago/Southland. This highlights the economic significance of these regions in the Māori business landscape.
- In the top three industries, sales per business are lower for Māori-owned businesses in Construction and Agriculture, Forestry, and Fishing, but higher in Professional, Scientific, and Technical Services.



Section 7. Exposure of Climate Hazards on Māori-owned Businesses

7.1 Context

In this section, we explore how Māori-owned businesses are exposed to climate hazards by examining important factors like business counts, employee numbers (including working proprietors), wages, and sales. While we primarily focus on Māori-owned businesses, we also compare them with businesses that are not Māori-owned.

To understand the potential effects of climate change on businesses, we set thresholds to identify potential harm for each climate hazard. Despite limited guidance in existing literature for these threshold values, we made subjective choices in this exploratory analysis and assessed the sensitivity of these results. We applied thresholds similar to those used in our previous exploratory study on Māori resilience in the face of climate change⁸.

For hazards related to flooding or coastal inundation due to sea level rise, we considered two thresholds:

- Any area flooded within the meshblock.
- At least 5% of the meshblock is flooded.

The choice of threshold was more intuitive than for the other climate variables because we expected any level of inundation would affect the business and that the magnitude of impact would increase in proportion to the flooded area.

For other climate hazards like extreme rainfall, wet spells, heatwaves, extreme hot days, and droughts, we used similar thresholds used in the earlier exploratory study on the exposure of Māori households to future climate hazards. We chose two thresholds based on projected changes in each variable from the base climatology and two thresholds based on absolute values of each variable. These are:

- Any projected change from the baseline climatology above zero.
- Any percentage change in the projected value above the baseline climatology greater than 10%.
- 80th percentile of the baseline climatology (1985-2005) value.
- 90th percentile of the baseline climatology (1986-2005) value.

We considered an area as 'affected, exposed, or at risk' if the relevant climate variable exceeded an assumed threshold that would impact the business. For instance:

- If the 90th percentile for heatwave days nationwide during 1986-2005 was 40 days, any meshblock with more than 40 projected heatwave days in the future was considered an area where the business could be affected, exposed, or at risk.
- If a particular meshblock had 25 wet spell days during 1986-2005 and the projection indicated more than 25 in the future, that meshblock was assumed to be an area where the business could be affected by future wet spells.
- If the number of extreme hot days in 1986-2005 was 10, and the projected future number was 11 or more, then that meshblock was considered an area where businesses could be affected by future extreme hot days.

⁸ <https://www.tpk.govt.nz/en/mo-te-puni-kokiri/our-stories-and-media/understanding-climate-hazards-for-hapori-maori>.



We have made subjective choices primarily to show how different decisions can affect the geographic reach of future climate change impacts. The methodology used could be modified outside the datalab environment.⁹

However, for the main findings in this insights report, we've used two thresholds. For flooding and coastal inundation due to sea level rise, we've used at least 5% of the meshblock flooded. For dry and wet climate hazards, we've used the 90th percentile of the baseline climatology (1985-2005) value to determine whether a business is affected by that climate hazard.

Māori-owned businesses face diverse climate hazards, with varying exposure levels across industries and regions. Agriculture-related sectors consistently show high vulnerability, emphasising the need for adaptive strategies in the face of changing climate conditions. Regional disparities highlight the importance of localised resilience measures.

7.2 Flooding

For this analysis, we considered at least 5 percent of the meshblock being exposed to the risk of flooding as the threshold.

Flooding vulnerability: a focus on Top 3 Māori industries

In terms of exposure current day flooding, Agriculture, Forestry, and Fishing emerges as the most vulnerable industry among the top three industries with the highest proportion of Māori-owned businesses, followed by Construction, and lastly, Professional, Scientific, and Technical Services.

The exposure of Māori workers, wages, and sales mirrors the patterns observed in the number of businesses.

⁹ Adapting the R script used in the IDI for creating these maps to explore alternative threshold choices and observe changes in geographic extent is a straightforward task. You can carry out these adjustments outside of the datalab environment. Additionally, it's easy

Table 3: Proportion of Māori-owned businesses exposed to current flooding

3a. Proportion of businesses in areas (meshblocks) exposed to any flooding due to sea level rise				
	% of Māori businesses exposed	% of Employees (including working proprietors) exposed	% of Wages exposed	% of Sales exposed
Agriculture, Forestry, and Fishing	72	69	66	71
Construction	62	62	61	63
Professional, Scientific, and Technical Services	57	57	54	55
3b. Proportion of businesses in areas exposed to at least 5% of meshblock flooding due to sea level rise				
Agriculture, Forestry, and Fishing	54	53	52	54
Construction	48	50	49	50
Professional, Scientific, and Technical Services	43	48	43	43

Source: Dataset released from Stats NZ IDI research

Exposure to flooding in these industries is similar for both Māori and non-Māori-owned businesses, with differences of 1 to 2 percentage points.

to modify the R script to display meshblocks that could be impacted by various combinations of climate events.



Understandably, exposure is less widespread with the 5% of meshblock threshold applied but still around half the businesses in the Agriculture, Forestry, and Fishing, and Construction industries are exposed to flooding hazard using this threshold.

Other Māori industries

Māori-owned businesses in all industries are exposed to flooding. This ranges from 54% to 68% of Māori-owned businesses in areas that are exposed to any level of flooding and 41% to 56% exposed to flooding of at least 5% of the meshblock.

Regional exposure to flooding

Flooding poses a considerable risk across all regions, with over half (62%) of all businesses located in meshblocks exposed to some degree of flooding. The regions with the highest exposure are Northland (91%), Auckland (71%), and Tasman/Nelson/Marlborough (67%).

The exposure level drops once a threshold of at least 5% of meshblock is applied, but still nearly half (48%) of Māori-owned businesses are situated in meshblocks exposed to at least 5% of meshblock flooding.

7.3 Sea Level Rise

Top 3 Māori industries affected by coastal inundation due to future sea level rise.

Accommodation and food services (26%), followed by Agriculture, Forestry, and Fishing (24%) then Wholesale Trade (23%) are the top 3 industries with the highest proportion of businesses in meshblocks predicted to be exposed to any flooding in the future (assuming a sea level rise of 50cm).

Māori-owned businesses in Accommodation and Food Services are more likely to be exposed to future coastal inundation (9 percentage points higher) than non-Māori-owned businesses.

When the threshold of at least 5% of meshblock is applied, Accommodation and Food Services is still projected to be the most exposed sector, followed by Retail Trade, and Manufacturing. Understandably, the level of exposure also drops.

The table below shows the predicted future exposure of the top 3 Māori industries in terms of economic contribution.

Regional exposure to coastal inundation due to sea level rise

Northland, the Bay of Plenty and Gisborne/Hawkes' Bay regions have the highest shares of Māori-owned businesses predicted to be affected by any coastal inundation due to sea level rise. Wellington has the lowest share of Māori-owned businesses exposed to sea level rise.

Table 4: Proportion of businesses exposed to coastal inundation due to sea level rise.

4a. Proportion of businesses in areas (meshblocks) exposed to any flooding due to sea level rise				
	% of Māori businesses exposed	% of Employees (including working proprietors) exposed	% of Wages exposed	% of Sales exposed
Agriculture, Forestry, and Fishing	24	21	21	22
Construction	17	16	14	17
Professional, Scientific, and Technical Services	16	12	13	16
4b. Proportion of businesses in areas exposed to at least 5% of meshblock flooding due to sea level rise				
Agriculture, Forestry, and Fishing	12	11	12	11
Construction	10	9	8	9
Professional, Scientific, and Technical Services	9	8	8	9

Source: Dataset released from Stats NZ IDI research



7.4 Extreme Hot Days

Currently, a small proportion of Māori-owned businesses, 7% of Māori-owned businesses, totalling 2,115, are in meshblocks that face extreme hot days (i.e. with values above the 90th percentile), and this is expected to increase to 17% in the future (i.e. with values above the 90th percentile), with 5,142 Māori-owned businesses affected in the future.

Although Māori-owned businesses generally share similar industry-level exposure with non-Māori counterparts, there are some differences with Agriculture, Forestry, and Fishing having the largest difference. Māori have a 19% exposure compared to 25% for non-Māori.

For the top 3 industries contributing to the Māori economy, Agriculture, Forestry, and Fishing, and Construction are projected to be the most exposed to extreme hot days in the future, with 19% and 17% of businesses in exposed meshblocks, indicating increases of 14 and 8 percentage points over the baseline, respectively.

Other highlights

- Currently, 8% of workers, or 6,600 workers, are situated in meshblocks exposed to extreme hot days.
- In the future, the proportion is projected to increase by 11 percentage points, representing a total of 8,965 additional employees including working proprietors.
- Manufacturing has the greatest proportion of workers exposed to future extreme hot days (24%) and is also projected to have the greatest percentage point increase in mid-century (2031-2050), with a 19-percentage point increase.
- Construction is projected to be the most exposed Māori industry in mid-century in terms of total wages exposed. (\$243m).

¹⁰ Some regions are left blank with no value, indicating that the numbers were small and/or had one dominant business contributing to the values. In these cases, information could not be released from the data lab as it was suppressed to protect the confidentiality of underlying businesses.

Regional exposure to extreme hot days

Currently, Māori-owned businesses face extreme hot days in three regions¹⁰: Canterbury, Otago/Southland, and Gisborne/Hawkes Bay.

In the future, Māori-owned businesses in these regions will continue to face extreme hot days, with Gisborne/Hawke's Bay expecting the largest increase (80 percentage points), followed by Canterbury (30 percentage points), and Nelson/Tasman/Marlborough region (26 percentage points).

7.5 Heatwaves

Currently, 13% of Māori-owned businesses, or 3,939 businesses, are exposed to heatwave days. The proportion is slightly higher for Māori workers, at 14%, or 11,410 Māori workers including working proprietors.

Māori-owned businesses and Māori workers in Agriculture, Forestry, and Fishing are currently the most exposed to heatwave days, with 22% of businesses (1,209 businesses) and 27% of workers (4,420 workers) exposed, respectively.

In the future, the number of Māori-owned businesses exposed to heatwave days is projected to increase to 68%, or 20,622 businesses exposed. This is an overall increase of 55-percentage points.

The number of Māori workers exposed to heatwave days is also projected to increase to 69%, or 57,560 workers. This is an overall increase of 55-percentage points.

Except for Agriculture, Forestry, and Fishing and Accommodation and Food Services, all other industries included in the analysis will see over 50 percentage point increases in future exposure compared to now.



Regional exposure to heatwaves

Māori-owned businesses in Northland are expected to face a significant increase in exposure to heatwaves, rising by 84-percentage points (from 11% to 95%). The Canterbury region follows with a 66-percentage point increase (from 4% to 70%) while the Waikato region is next, with 60-percentage point rise (from 32% to 92%).

Presently, the North Island regions leading in the exposure of Māori-owned businesses to heatwaves in Agriculture, Forestry, and Fishing are Gisborne/Hawke's Bay (62%), Waikato (42%), Bay of Plenty (36%), and Wellington (25%).

In the future, Māori-owned businesses in Agriculture, Forestry, and Fishing within Gisborne/Hawke's Bay (96%), Northland (95%), and Waikato (93%) are expected to experience heatwaves, each with an exposure of 93% or more. Once again, these regions are all situated in the North Island.

Additionally, Northland, has the greatest proportion of businesses in Agriculture, Forestry, and Fishing.

7.6 Drought

Māori-owned businesses current exposure to drought is at 9%, and the proportion will increase to more than a quarter (27%) in the future, an 18 percentage points increase from baseline.

Accommodation and Food Services are currently the most exposed industry (13%), followed by Agriculture, Forestry, and Fishing (11%).

Currently, the top three industries with the highest proportion of Māori workers exposed to drought are Manufacturing (16%), Accommodation and Food Services (16%), and Agriculture, Forestry, and Fishing (14%).

In the future, Agriculture, Forestry, and Fishing will have the highest proportion of Māori-owned businesses exposed to drought (29%) of the top 3 industries in terms of economic contribution. The projected

increase in proportion of businesses exposed to drought is remarkably constant across industries with most experiencing increases of 18 to 19 percentage points.

Regional exposure to drought

At present, Māori-owned businesses in the Gisborne and Hawke's Bay regions face a high exposure to drought at 77%, and this is expected to increase to 99% in the future.

The Māori-owned businesses in the combined regions of Tasman, Nelson, and Marlborough, as well as the Canterbury region, are also projected to experience higher exposure to drought, at 79% with 43 and 63 percentage points increase from baseline, respectively.

Conversely, Māori-owned businesses in Auckland and Northland are anticipated to be the least exposed to drought, at 2%.

7.7 Extreme Rainfall

Currently, 14% of Māori-owned businesses are at risk from extreme rainfall, i.e. 14% are situated in meshblocks with extreme rainfall values in the 90th percentile. This represents 4,191 businesses. In the future, this number is expected to increase slightly to 4,374 businesses (still 14%).

Māori-owned businesses in Agriculture, Forestry and Fishing are the most exposed to extreme rainfall. Currently, more than one-quarter (26%) of Māori-owned businesses in this sector are exposed. This proportion is expected to increase slightly to 28% in the future.

Accommodation and Food services is the second most exposed Māori sector. Currently, less than one-fifth (19%) of Māori-owned businesses in this sector are exposed. This proportion is expected to increase slightly to 20% in the future.

Māori-owned businesses in Information, Media and Telecommunications are the least exposed to extreme rainfall.



Māori workers, including both employees and working proprietors, in Agriculture, Forestry, and Fishing face the highest exposure to extreme rainfall. Currently, approximately one-fifth (21%) of Māori workers in this sector are exposed.

Regional exposure to extreme rainfall

At present, Māori-owned businesses in Northland face the highest exposure to extreme rainfall, standing at 58%. However, this percentage is projected to decrease by 11 percentage points to 47% in the future.

The Bay of Plenty follows, with 38% of Māori-owned businesses currently exposed to extreme rainfall. In the future, this region is expected to have the highest percentage of businesses exposed to extreme rainfall at 50%, an increase of 12 percentage points.

7.8 Wet Spell Days

As the climate is anticipated to become hotter and drier, the number of wet spell days is expected to decrease. Currently, 11% of Māori-owned businesses are in meshblocks exposed to wet spells (i.e. with values in the 90th percentile). This proportion will decrease to 8% in the future.

Agriculture, Forestry, and Fishing is the industry most exposed to wet spell days.

Regional exposure to wet spell days

At present, Māori-owned businesses in the combined regions of Taranaki, Whanganui, and West Coast face the highest exposure to wet spells, at 44%. This is followed by Northland at 18% and Waikato at 13%. The same regions are projected to have relatively high exposure to wet spells in the future compared with other regions, although there will be fewer wet spell days in these regions and overall.



Section 8. Regional Exposure

We investigated the possible climate risks that Māori-owned businesses might encounter for each region now and in the future.

We found that, except for Wellington, every area demonstrates a higher-than-average likelihood of facing one or two climate challenges for Māori-owned businesses currently or in the future. Northland and Tasman/Nelson/Marlborough have the most exposures, each with five. Gisborne/Hawke's Bay and Bay of Plenty come next with three each, while Auckland and Canterbury have two, and Otago/Southland has one.

The most susceptible region based on the average ranking of regional councils to all climate hazards is Gisborne/Hawke's Bay and then Northland and Tasman/Nelson/Marlborough. Wellington is the least susceptible region, followed by Otago/Southland.

[Table 5](#) illustrates the susceptibility of Māori-owned businesses in various regions to diverse climate hazards.



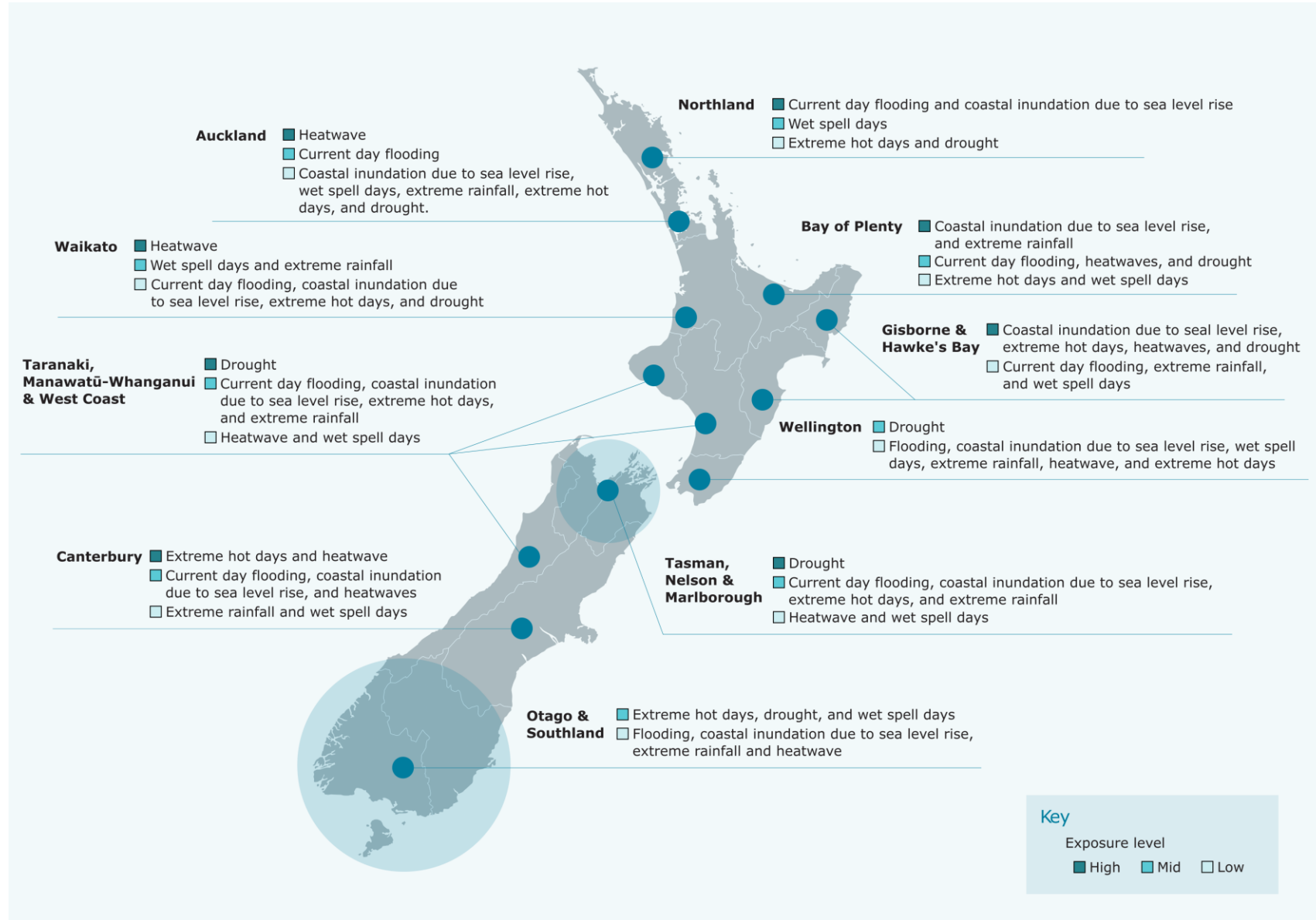
Table 5: Proportion of businesses exposed to climate hazard in future (except flooding) by region.

This table provides percentage of exposure of Māori-owned businesses to various climate hazards for different regions in New Zealand, as well as a national weighted average.

	Current day flooding	Sea level rise in future	Extreme hot days in future	Heatwave days in future	Drought in future	Extreme rainfall in future	Wet spell days in future
Northland	74	21	-	95	2	47	13
Auckland	52	6	-	94	2	2	3
Waikato	45	8	-	92	6	13	10
Bay of Plenty	48	22	1	64	34	50	1
Gisborne/ Hawke's Bay	43	18	87	99	99	9	4
Taranaki/ Whanganui/ West Coast:	36	6	2	15	29	19	38
Wellington	41	5	8	14	17	2	1
Tasman/ Nelson/ Marlborough	52	13	26	39	79	21	3
Canterbury	50	10	93	70	79	-	-
Otago/ Southland	38	7	21	19	28	-	8
National Weighted Average	48	10	17	68	27	14	8

The study also highlighted regions in which Māori-owned businesses face high, medium (mid) or low exposure to different climate hazards in the future compared to the overall average risk ranking. We applied the **k-means clustering algorithm** to partition the regions into three groups: **Low**, **Mid**, and **High**. These groups correspond progressively to higher risk levels for each respective climate hazard. Refer to Table 2, page 9, for a summary table of this grouping.

MAP D: Climate Hazards Exposure Levels by Region



8.1 Top 3 Māori Industries across regions

We provided further analysis on how the Top 3 industries with the most prevalent Māori-owned businesses might be affected by the different climate hazards for each region.

8.1.1 Construction

In Auckland, 29% of Māori-owned businesses are in Construction, totalling 2,124 businesses.

The regions where Māori-owned businesses in the Construction industry is most exposed in future wet and dry climate hazards, using the using 90th percentile threshold, are as follows:

- Wet spells: Taranaki/Whanganui/West Coast (38%)
- Extreme rainfall: Northland (46%), Bay of Plenty (45%)
- Drought: Gisborne/Hawke's Bay (98%), Canterbury (85%), Tasman/Nelson/Marlborough (73%)
- Heatwaves: Gisborne/Hawke's Bay (100%), Northland (96%), Auckland (93%), Waikato (93%), Canterbury (74%).
- Extreme hot days: Canterbury (96%), Gisborne/Hawke's Bay (91%)

At present, Māori-owned businesses in Northland (69%) and Auckland (54%) are facing the highest exposure to current flooding.

Looking ahead to future coastal inundation due to sea level rise, Gisborne/Hawke's Bay (21%), Bay of Plenty (19%), and Northland (17%) are expected to be the most affected regions.

These regions face high risks from extreme weather, potentially disrupting schedules and causing project challenges. Delays or material shortages can inflate costs for Māori-owned businesses.

Despite these challenges, the Construction sector presents substantial opportunities¹¹, with an estimated \$240 billion spending forecast from 2022 to 2027, primarily from private and government sources.

¹¹ The Infracom platform is online here <https://tewaihanga.govt.nz/the-pipeline>.



Table 6: Proportion of Māori-owned Construction Businesses per Region and their Exposure to Climate Hazards

	Current day flooding	Sea level rise in future	Extreme hot days in future	Heatwave days in future	Drought in future	Extreme rainfall in future	Wet spell days in future
Northland	69	17	-	96	2	46	6
Auckland	54	6	-	93	2	2	4
Waikato	41	7	-	93	8	12	8
Bay of Plenty	51	19	1	64	35	45	1
Gisborne/ Hawke's Bay	44	21	91	100	98	5	1
Taranaki/ Whanganui/ West Coast:	32	7	2	13	32	16	38
Wellington	43	4	7	11	15	3	2
Tasman/ Nelson/ Marlborough	49	14	23	34	75	18	1
Canterbury	50	14	96	74	85	-	-
Otago/ Southland	31	5	31	31	40	-	4
National Weighted Average	48	10	17	70	27	12	6

Source: Dataset released from Stats NZ IDI research

Here are the key points from Table 5 regarding how Māori-owned construction businesses might be affected by selected climate hazards.

- **Northland:** Has the highest proportion of Māori-owned businesses exposed to current day flooding at 69%, and it also leads in exposure to future extreme rainfall at 46%, surpassing other regions. Additionally, it ranks second in terms of the proportion of Māori-owned businesses exposed to future heatwaves.
- **Gisborne/Hawke's Bay:** In the future, Māori-owned construction businesses in these combined regions are anticipated to have the highest exposure to coastal inundation due to rising sea levels at 21%, heatwaves at 100%, and drought at 98%. Moreover, it ranks second in terms of exposure to extreme hot days at 91% compared to all regions.
- **Taranaki/Whanganui/West Coast:** Stands out as the region most vulnerable to future wet spell days, with 38% of Māori-owned businesses exposed. In contrast, all other regions show considerably lower exposure, ranging from only 1% to 8% of Māori-owned businesses.
- **Wellington:** The sole region where Māori-owned businesses exhibit below national average exposure to all climate hazards.
- **Canterbury:** Has the highest percentage of Māori-owned businesses exposed to future extreme hot days at 96%, and it ranks second with an 85% exposure to future drought among Māori-owned businesses.
- **Otago/Southland:** Exposure to all climate hazards is below national average, except for drought, which is above national average.



8.1.2 Agriculture, Forestry and Fishing

Māori-owned businesses in Agriculture, Forestry and Fishing play a significant role in certain regions, particularly those abundant in agricultural land such as Taranaki/Whanganui/West Coast (32%), Otago/Southland (31%), Northland (29%), Gisborne/Hawke's Bay (27%), and Waikato (26%).

When using the 90th percentile threshold, our study reveals that Agriculture, Forestry, and Fishing in Taranaki/Whanganui/West Coast (43%) and Northland (26%) are most exposed to future wet spells. Bay of Plenty and Northland are forecasted to be most exposed in the future to extreme rainfall. The Bay of Plenty is most exposed to rising sea levels. Northland and Waikato will be most exposed to heatwaves in the future, at 95% and 93%, respectively.

Bay of Plenty and Northland are forecasted to be most exposed in the future to extreme rainfall.

The Bay of Plenty is most exposed to rising sea levels.

Waikato will be most exposed to heatwaves in the future.

The prospect of more frequent severe droughts, particularly in Gisborne/Hawke's Bay and Tasman/Nelson/Marlborough regions, poses a threat to agriculture, affecting water availability for irrigation and livestock, and potentially impacting crop yields.



Table 7: Proportion of Māori-owned businesses in Agriculture, Forestry and Fishing and their Exposure to Climate Hazards per Region.

The table shows the percentage of Māori-owned businesses exposed to the various climate hazards in the regions covered by this study.

	Current day flooding	Sea level rise in future	Extreme hot days in future	Heatwave days in future	Drought in future	Extreme rainfall in future	Wet spell days in future
Northland	79	20	-	95	4	50	26
Auckland	85	19	-	75	3	4	4
Waikato	52	9	-	93	3	19	15
Bay of Plenty	40	26	3	72	36	81	2
Gisborne/ Hawke's Bay	42	10	73	96	95	22	13
Taranaki/ Whanganui/ West Coast:	41	2	2	16	24	28	43
Wellington	56	4	38	77	60	10	12
Tasman/ Nelson/ Marlborough	65	12	30	49	77	33	8
Canterbury	53	3	85	71	55	1	1
Otago/ Southland	48	10	13	10	16	0	16
National Weighted Average	54	12	19	65	29	28	17

Source: Dataset released from Stats NZ IDI research

Māori -owned businesses in Agriculture, Forestry, and Fishing face diverse climate risks. Here are some key insights from the table above:

- **Northland:** Ranks second highest among regions regarding proportion of Māori-owned businesses exposed to various climate hazards. These hazards include current-day flooding (79%), coastal inundation from rising sea levels (20%), future heatwaves (95%), extreme rainfall (50%), and wet spells (26%).
- **Auckland:** Holds the highest percentage of Māori-owned businesses exposed to current-day flooding at 85% and secures the third position in exposure to coastal inundation from rising sea levels, affecting 19% of Māori-owned businesses.
- **Waikato:** Takes the third position, with a significant proportion of Māori-owned businesses, at 93%, exposed to future heatwave days.
- **Bay of Plenty:** In the future, exhibits the highest percentage of Māori-owned businesses exposed to coastal inundation due to sea level rise, at 26%, and it also ranks highest for exposure to extreme rainfall at 81%.
- **Gisborne/Hawke's Bay:** In the future, holds the highest percentage of Māori-owned businesses exposed to heatwaves at 96% and ranks highest for exposure to drought at 95%. This region is also the second most exposed to extreme hot days, at 73%.
- **Taranaki/Whanganui/West Coast:** Holds the highest percentage of Māori-owned businesses exposed to wet spell days in the future, standing at 43%.
- **Wellington:** Ranked third in terms of the percentage of Māori-owned businesses exposed to extreme hot days at 38% and drought at 60% in the future.



- **Tasman/Nelson/Marlborough:** Holds the second rank for the proportion of Māori-owned businesses exposed to future drought at 77%. Also, it ranks third for proportion of Māori-owned businesses exposed to current-day flooding at 65% and future extreme rainfall at 33%.
- **Canterbury:** Secures the top rank in the future for the proportion of Māori-owned businesses exposed to extreme hot days, standing at 85%.
- **Otago/Southland:** Ranked third for the proportion of Māori-owned businesses exposed to wet spell days in the future, at 16%.

8.1.3 Professional Scientific and Technical Services

In this industry, Auckland boasts the highest number of Māori-owned businesses, totalling 1,596, while Wellington has the highest proportion of Māori-owned businesses at 25%.

Māori-owned businesses in Northland and Bay of Plenty are most vulnerable to rising sea levels. Additionally, Northland stands out as having the highest percentage of Māori-owned businesses exposed to the immediate risk of flooding.

The region's most vulnerable to future wet and dry climate hazards in the Professional, Scientific, and Technical Services sector, considering the 90th percentile threshold, are as follows:

- Extreme hot days: Gisborne/Hawke's Bay (97%), Canterbury (97%)
- Heatwaves: Gisborne/Hawke's Bay (100%), Northland (99%), Auckland (97%)
- Drought: Gisborne/Hawke's Bay (100%), Canterbury (90%), Tasman/Nelson/Marlborough (85%)
- Extreme rainfall: Northland (45%), Bay of Plenty (38%)
- Wet spells: Taranaki/Whanganui/West Coast (32%)

For current-day flooding, Māori-owned businesses in Northland face the highest exposure at 75%.

Looking ahead to coastal inundation from future sea level rise, both Northland and the Bay of Plenty share equal vulnerability, with 21% of Māori-owned businesses in each region expected to be exposed.



Table 8: Proportion of Māori-owned businesses in Professional, Scientific and Technical Services and their exposure to climate hazard in various regions

The table shows the percentage of Māori-owned businesses exposed in different climate hazards in the regions under study.

	Flooding in current day	Sea level rise in future	Extreme hot days in future	Heatwave days in future	Drought in future	Extreme rainfall in future	Wet spell days in future
Northland	75	21	-	99	-	45	6
Auckland	44	6	-	97	1	1	2
Waikato	44	6	-	92	7	8	7
Bay of Plenty	49	21	-	63	37	38	-
Gisborne/ Hawke's Bay	39	18	97	100	100	3	-
Taranaki/ Whanganui/ West Coast:	34	7	3	15	35	12	32
Wellington	33	4	2	6	10	1	-
Tasman/ Nelson/ Marlborough	36	15	24	36	85	9	-
Canterbury	49	8	97	70	90	-	-
Otago/ Southland	30	6	30	28	36	-	2
National Weighted Average	43	9	14	69	22	8	4

Source: Dataset released from Stats NZ IDI research

Here are the key points highlighting the potential exposure to various climate hazards of Māori-owned businesses in Professional, Scientific and Technical Services:

- **Northland:** Has the highest proportion of Māori-owned businesses exposed to current day flooding (75%), coastal inundation due to sea level rise (21%), and extreme rainfall (45%). Additionally, it has the second-highest proportion of Māori businesses exposed to heatwaves in the future (99%).
- **Auckland:** Ranked third in the proportion of Māori-owned businesses exposed to heatwaves in the future, at 97%.
- **Bay of Plenty:** Tied with Northland as having the highest proportion of Māori-owned businesses exposed to coastal inundation due to sea level rise (21%), ranks second for extreme rainfall (38%), and is tied for third with Canterbury in terms of current day flooding (49%).
- **Gisborne/Hawke's Bay:** Takes the lead in the proportion of Māori-owned businesses exposed to future heatwaves (100%), and

drought (100%). It also ties with Canterbury as the region with the highest proportion of Māori-owned businesses exposed to future extreme hot days (97%).

- **Taranaki/Whanganui/West Coast:** Stands out as the region most susceptible to future wet spell days, with 38% of Māori-owned businesses exposed, while other regions exhibit lower exposure at 7% or under.
- **Wellington:** The sole region where Māori-owned businesses exhibit below national average exposure to all climate hazards.
- **Tasman/Nelson/Marlborough:** Ranks first for the proportion of Māori businesses exposed to drought in the future, at 85%.
- **Canterbury:** Ties for first place with Gisborne/Hawke's Bay regions for the highest proportion of Māori-owned businesses exposed to extreme hot days (97%). Additionally, it is ranks second in exposure to future drought at 90%.



Section 9. Conclusion

Our study underscores the following:

Industry Concentration: Māori-owned businesses play a significant role in key sectors such as Construction, Agriculture, Forestry and Fishing, and Professional, Scientific, and Technical Services, comprising 56% of Māori-owned businesses.

Regional Variances: The concentration of these businesses varies across regions, with Auckland dominating Construction and rich agricultural lands hosting Agriculture, Forestry, and Fishing businesses.

Climate Hazard Vulnerability: Māori-owned businesses, particularly in Agriculture, Forestry, and Fishing, are notably vulnerable to climate hazards, with extreme rainfall and wet spells posing significant risks.

Regional Exposure: Gisborne/Hawke's Bay, Northland, and Tasman/Nelson/Marlborough are identified as regions with the highest exposure of Māori-owned businesses to various climate hazards.

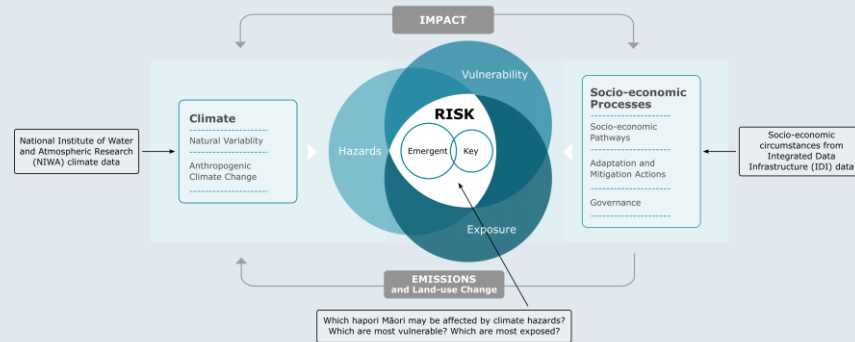
Economic Contribution: Māori-owned businesses contributed \$10.85 billion to New Zealand's economy in 2020, underscoring their economic significance.

This study provides valuable data for informed decision-making, highlighting the interconnectedness of industry dynamics and characteristics, climate hazards, and regional dynamics in shaping the Māori business landscape. It could be a guide for policymakers and businesses, stressing the importance of nuanced regional strategies in addressing the complex intersection of industry concentration and climate risks for Māori enterprises.



Appendix A: Methodology Discussion in More Detail

This analysis explores how Māori-owned businesses are affected by various climate hazards. The method used is illustrated in the following diagram (Oppenheimer et al. 2014)¹².



The analysis mainly focused on the central area of intersection (the white area in the middle of the diagram). We studied how Māori-owned businesses are exposed to current and future climate hazards in comparison to their present-day profiles. The goal was to identify the businesses or industries most at risk and potentially vulnerable to both current and future climate hazards. This information, when considered alongside other factors like population density, terrain type, and access to resources, can provide insights into potential strategies for businesses that might need to adapt or transform due to changing climate conditions.

Businesses can be impacted by local climate conditions near their location (e.g., affecting production) or by conditions in other parts of the country or overseas (e.g., impacting the supply chain and prices). Initially, this analysis focused on the connection between the

¹² Excerpt from Oppenheimer et al (2014). Climate Change 2014: Impacts, Adaptation and Vulnerability, Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.

¹³ The projections were based on a global emission trajectory called Representative Concentration Pathways (RCP), developed by IPCC and used in global climate models - RCP 4.5 (low-moderate). Note

characteristics and performance of Māori-owned businesses and local climate conditions, setting aside the effects of remote changes.

Climate-related indicators and data

This analysis utilised annual climate maps from NIWA, previously used in a project on the resilience of Māori households to climate change (reference included). The climate hazard indicators included:

- Flooding – areas that are flooded
- Sea level rise - Areas that are inundated at extreme coastal sea levels based on the 1% Annual Exceedance Probability (1 in 100-year event) with no sea level rise (baseline) and 50cm sea level rise (a future projection)
- Wet spells - Number of days per year where rainfall exceeds 1mm for 5 or more consecutive days
- Extreme rainfall - Number of days per year with rainfall greater than 30mm
- Extreme hot days - Number of days per year with maximum temperature exceeding 30°C
- Heat wave days - Number of days per year where maximum temperature exceeds 25°C for 3 or more consecutive days
- Drought - Probability of PED (potential evapotranspiration deficit) exceeding 200 mm

The climate maps cover a baseline period (1986-2005 average) and projected changes¹³ by mid-century (2031-2050 average), except for sea-level rise and flooding maps, which used all available historic data

that the most recent IPCC Assessment AR6 report introduced the concept of Shared Socio-Economic (SSE) Pathways which factor socio-economic factors into future scenarios. However, NIWA has not yet undertaken modelling based on the SSE pathways, so we used climate projections based on RCPs instead.



(2021). The sea level rise maps were provided in 10cm sea level rise increments.

All NIWA climate datasets were summarised at the meshblock-level to facilitate linking to business information derived from Statistics NZ datasets. A meshblock is the smallest geographic area used by Statistics NZ, varying in size from part of a city block to large areas of rural land. The sea level rise dataset was summarised at a broader level (using Statistical Area SA2) because we did not have time to remap the dataset from the previous project.

To understand the exposure of businesses to climate impacts, we first needed to identify thresholds above which harm was assumed to occur to the economy for each climate hazard. However, there was little guidance in the literature on appropriate threshold values or where guidance was available, we did not have the data to apply it. The approach used in this exploratory analysis was to make some subjective choices and examine the sensitivity of the results. We considered the following thresholds used in earlier exploratory study on the exposure of Māori households to future climate hazards and examined the exposure of businesses to climate hazards based on these thresholds:

For coastal inundation due to sea level rise:

- Any area flooded within a meshblock
- At least 5% of meshblock flooded

For flooding:

- Any area flooded within meshblock

¹⁴ The thresholds based on 80th/90th percentiles of baseline climatology were applied to current and future maps and any values above these thresholds were considered as exposed; the other two thresholds relate to changes in the future exposure only.

¹⁵ These are national databases containing administrative and survey data on economically significant businesses and people living in New Zealand, respectively. The LBD contains longitudinal records of financial and employment data and business characteristics, such as business structure, industry and geographic location. The most recent complete dataset (tax year ending 2020) was used.

- At least 5% of the meshblock flooded

For all other climate hazards (e.g. heatwaves days, wet spell days etc.)¹⁴:

- 80th/90th percentile of the baseline climatology (1986-2005) value e.g., the 90th percentile for heat-wave days across the country in 1986-2005 was 40 days. Using this threshold, any region that had more than 40 projected heat-wave days in the future is assumed to be an area where businesses might be affected.
- any projected change from the baseline climatology above zero (e.g. if the number of heatwave days in 1986-2005 was 25 for a particular region, and projected to be greater than 25 in the future, then that region was assumed to be an area where the economy might be affected by future heatwaves)
- any percentage change in the projected value above the baseline climatology greater than 10% e.g. if the number of extreme hot days in 1986-2005 was 10, and projected future number was 11 or greater, then that region was assumed to be an area where businesses were affected by future extreme hot days

Business-related indicators and data

The analysis utilised a comprehensive dataset with business indicators from the Longitudinal Business Database (LBD) and the Integrated Data Infrastructure (IDI)¹⁵. These indicators provided information on the characteristics and financial performance of businesses by industry and location.

Key LBD tables used included firm-level labour and productivity measures (Fabling and Mare productivity tables)¹⁶, with information linked to plant-level locations and industries. Ethnicity information for

¹⁶ Fabling, Richard and David C Maré. 2019. "Improved productivity measurement in New Zealand's Longitudinal Business Database." Motu Working Paper 19-03. Motu Economic and Public Policy Research. Wellington, New Zealand.

people working in the businesses came from core IDI datasets, using Māori descent data from Census 2013 and 2018¹⁷.

The analysis focused on data from the 2020 tax year (ending March 2020) to describe baseline business statistics and avoid the COVID-19 period.

Two definitions of a Māori business were chosen following sensitivity analysis and consultation:

1. A business with at least one working proprietor who self-identified as Māori or had Māori descent with non-zero employment income in 2020.
2. A business with a Māori sole proprietorship or at least 50% of shareholder income associated with Māori who self-identified as Māori or had Māori descent with non-zero employment income in 2020.

The final business dataset comprised one row for each business–meshblock–industry combination, including various business measures such as the number of working proprietors and employees, total wages, total sales, and labour productivity.

The last step involved combining business and climate information based on the location of the business, aggregating over industry/regional areas to provide summary information on current and future exposures to climate hazards.

All business information was summarised into broad geographic areas to protect confidentiality, using regional council areas where possible. In some cases, adjacent regional councils were grouped together for reporting. For instance, the West Coast regional council was grouped with Taranaki and Whanganui councils due to similar climate conditions rather than neighbouring councils in the South Island.

¹⁷ Following internal consultation, a choice was made to combine 'yes' responses associated with Maori descent from both Censuses rather than only use one Census year. This may overinflate Māori descent numbers since people's responses to this question may vary over time for various reasons. See also

<https://datainfolplus.stats.govt.nz/Item/nz.govt.stats/beef1f6b-3623-4f56-9672-0f812653244f> for information regarding completeness and imputation used in Census 2018.



Appendix B: Steps in Producing a Business Dataset

The starting point for the dataset was a set of derived business tables produced by Fabling and Maré¹⁸. There are two sets of tables: one in the Longitudinal Business Database (LBD) environment and the other in the Integrated Data Infrastructure (IDI). The two versions are closely related. The LBD versions focus on measures relating to the business including, e.g. sales, productivity, number of employees and working proprietors and overall business characteristics (e.g. industry). The IDI versions provide more information about the people associated with these businesses, e.g. counts of employees and working proprietors by ethnicity, but do not include all business information, such as sales and productivity measures. Some of the IDI tables include person-level information, whereas the LBD tables are business-level.

Māori-owned business definition

The initial dataset included all businesses with at least one working proprietor (WP) who self-identified as Māori and/or had Māori descent in the tax year ending 2020. The choice of the 2020 tax year was guided by the completeness of the data and to avoid the COVID19 period in order to describe baseline business statistics. Ethnicity information relating to working proprietors was obtained from core IDI datasets; descent information came from Census 2013 and 2018¹⁹.

This initial dataset was considered a potential pool of businesses from which to draw other subsets depending on the definition of a Māori business. A range of options were considered for the definition of a Māori business:

1. The business had at least one working proprietor who self-identified as Māori ethnicity and/or had Māori descent (the initial pool)

2. The business had at least one working proprietor who self-identified as Māori ethnicity
3. The business had at least one working proprietor who self-identified as Māori ethnicity and/or had Māori descent and who had non-zero self-employment income in 2020 tax year
4. The business was either:
 - a Māori sole proprietorship (with non-zero self-employment income), or
 - at least 50% of shareholder income in 2020 tax year that was paid to directors, partners or active shareholders was associated with Māori
 - (where Māori was defined by Māori self-identified ethnicity and/or Māori descent)

These definitions were chosen to align with the Te Matapaeroa project where at least 50% of shareholder wages that are paid to directors, partners or active shareholders are associated with Māori.

Sensitivity analysis was undertaken to explore the effect of applying different definitions on the numbers of businesses included as Māori-owned businesses. The main output produced for this report focuses on two preferred definitions (3 and 4 in the list above).

Assigning geographic and industry information to each business

To assign geographic and industry information to each business, the process goes through several detailed steps:

Initial Data Gathering: Financial and productivity data are initially recorded at the enterprise level (ent). Each enterprise, which could be a

¹⁸ Fabling, Richard and David C. Maré. 2019. "Improved productivity measurement in New Zealand's Longitudinal Business Database." Motu Working Paper 19-03. Motu Economic and Public Policy Research. Wellington, New Zealand.

¹⁹ Following internal consultation, a choice was made to combine 'yes' responses associated with Māori descent from both Censuses rather than only use one Census year. This may overinflate Māori descent numbers since people's responses to this question may vary over time for various reasons. See also <https://datainplus.stats.govt.nz/item/nz.govt.stats/beef1f6b-3623-4f56-9672-0f812653244f> for information regarding completeness and imputation used in Census 2018.

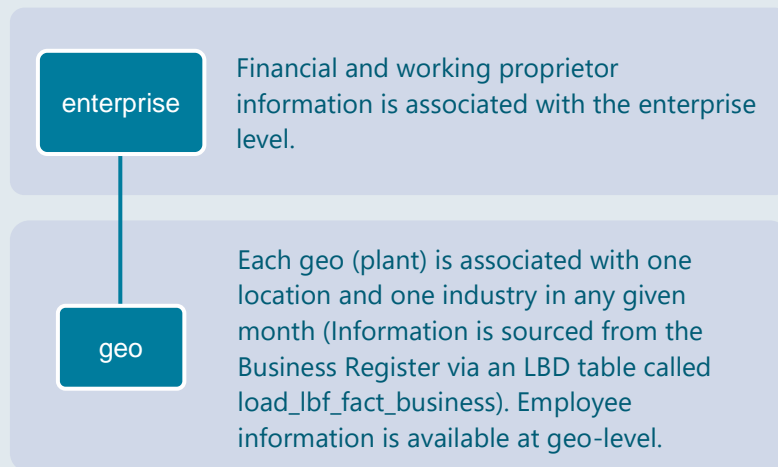
company, partnership, or sole proprietorship, engages in one or more economic activities, categorised by industry. A permanent enterprise number (pent) is used to identify each entity, recognising that these numbers might change over time for accounting purposes but represent the same entity.

Understanding Plants and Locations: An enterprise can have one or more geographic units (geo) or 'plants', which are the operational units at specific locations. Each plant is linked to a meshblock, identifying its location. This information is sourced from the Business Register or derived tables in the Longitudinal Business Database (LBD). These tables provide a history of plant locations, industries, and indicators of whether the plant was active during specific periods. Another related table holds plant-level employee data.

Handling Complex Businesses: Larger businesses often have multiple plants engaged in various activities across different locations.

The following schematics illustrates two examples.

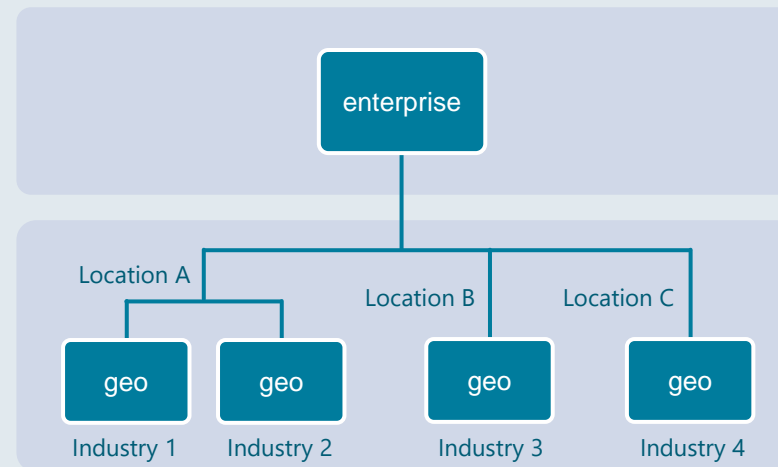
Example 1



The schematic illustrates a simple example, in the case where there is only one plant/geo. All employees, working proprietors and financial information are associated with one location and one industry.

Example 2

In more complicated firms, there may be several plants undertaking different activities at different locations. The schematic below shows an enterprise with four plants, each associated with a different industry, and based in three different locations.



Step 1 involves assigning meshblock and industry details to each plant or location (also known as a geo).

We examine the Business Register or the relevant LBD table, *load_lbf_fact_business*, which contains data on the number of employees each month and their workplaces, primarily for companies that employ staff. However, for most WP-only companies, we lack location details. Additionally, while these tables provide information about the industry of the entire company, they do not specify the industry of each individual location, which could vary.

Our initial step involves collecting all the records for each plant or location during the tax year 2020. This process may yield a single record for a company with a simple structure, i.e., with only one location and one industry, or multiple records for larger companies operating across diverse locations and industries.

Typically, this method proves effective, allowing us to retrieve location (meshblock) and industry details. However, there are instances where we may not find the necessary information due to two primary reasons:

- The record was found, but it lacked meshblock or industry details.
- No records were available in the table for that particular tax year.

Following the record matching process, the next step involves data cleaning. This means assessing whether a plant was considered active during a specific period. Based on this information, some records associated with inactive plants are filtered out. However, the specific approach varies depending on the type of firm:

For firms that employ people: All records are kept, even if the indicators suggest that the plant was not active. This decision is justified by the presence of monthly employee records, which indicate ongoing work despite the business register flag.

For single-plant WP-only firms (non-employing): All records are retained, irrespective of the business register indicating the plant is not active. This decision is grounded in the certainty regarding the plant's location and industry. These firms have met specific criteria for inclusion in the derived tables, likely based on sales or other relevant metrics.

For multi-plant WP-only firms: If a firm has multiple plants over a period, only information from active plant records is used. If no active plant records exist, the firm is categorized as part of the unmatched group.

Step 2 entails assigning meshblock and industry information to each plant, but with a slight modification to the approach used in Step 1.

Instead of strictly adhering to the initial time restrictions, we relax them slightly. We begin by focusing on firms that were not matched in the first round. Next, we search for the record closest in time that provides location information. The same cleaning procedures as before are then applied.

Following these steps, we successfully matched nearly all records. However, a very small number of multi-plant records contained plant-level information in the underlying table, yet none of them were active. For these firms, we used the location and enterprise details from the closest available record in time, disregarding the business register flag.

Step 3 serves to fill in the gaps in information:

- **Industry Imputation:** If the industry for a specific location is unknown, we use the industry associated with the entire company.
- **Location Imputation:** If the location of a business is unknown, the addresses of the owners are used. If all the addresses are identical or if there is only one owner, we assign the corresponding meshblock. However, if the addresses differ, the location remains classified as unknown.

Creating the Final Dataset: The finalised dataset comprises one row for each combination of enterprise, meshblock, and industry. In instances of multiple plants, working proprietors are evenly distributed across meshblock-industry pairs. Furthermore, the total labour headcount for each enterprise is calculated, and weights are assigned based on the labour share. These weights sum to one for each pent (business).

Appendix C: Summary Table of Businesses by Industry

The table below shows the number and percentages of businesses owned by Māori and non-Māori in various industries for the year 2020. The data includes business counts, percentages, and the distribution across different industry sectors. The data is sourced from Stats NZ IDI research dataset produced for this exploratory analysis.

Business Counts					
Industry	Māori		Non-Māori		
	Count	%	Count	%	
Construction	7,221	23.8	43,395	16.9	
Agriculture, Forestry and Fishing	5,514	18.2	38,208	14.9	
Professional, Scientific and Technical Services	4,302	14.2	44,979	17.5	
Retail Trade	2,037	6.7	19,947	7.8	
Accommodation and Food Services	1,668	5.5	12,819	5.0	
Manufacturing	1,395	4.6	11,934	4.7	
Other Services	1,308	4.3	11,589	4.5	
Administrative and Support Services	1,200	4.0	15,786	6.2	
Transport, Postal and Warehousing	1,182	3.9	12,369	4.8	
Rental, Hiring and Real Estate Services	1,179	3.9	14,115	5.5	
Health Care and Social Assistance	879	2.9	9,660	3.8	
Wholesale Trade	759	2.5	4,686	1.8	
Arts and Recreation Services	540	1.8	6,780	2.6	
Education and Training	429	1.4	3,225	1.3	
Financial and Insurance Services	390	1.3	2,865	1.1	
Information Media and Telecommunications	351	1.2	4,023	1.6	
Total	30,354	100	256,380	100	



Appendix D: Summary Table on Employee Numbers (including working proprietors) by Industry

The table outlines the employee numbers, including working proprietors, in various industries for Māori and non-Māori businesses. The data includes headcounts, percentages, and mean headcounts for each industry in 2020. The data is sourced from Stats NZ IDI research dataset produced for this exploratory analysis.

Employee Numbers (Including Working Proprietors)						
Industry	Māori			Non-Māori		
	Count	%	Mean	Count	%	Mean
Construction	16,650	19.8	2.3	118,600	15.5	2.7
Agriculture, Forestry and Fishing	16,270	19.4	3.0	104,700	13.6	2.7
Professional, Scientific and Technical Services	12,250	14.6	2.9	94,900	12.4	2.1
Retail Trade	6,010	7.2	5.1	84,400	11.0	6.0
Accommodation and Food Services	5,150	6.1	5.9	61,900	8.1	6.4
Manufacturing	4,540	5.4	3.8	64,400	8.4	5.2
Other Services	4,160	5.0	2.5	35,500	4.6	2.8
Administrative and Support Services	4,070	4.9	2.9	37,600	4.9	3.2
Transport, Postal and Warehousing	3,430	4.1	2.6	29,840	3.9	2.6
Rental, Hiring and Real Estate Services	3,090	3.7	1.5	27,500	3.6	1.4
Health Care and Social Assistance	3,015	3.6	2.5	37,000	4.8	2.3
Wholesale Trade	1,785	2.1	3.3	34,030	4.4	5.0
Arts and Recreation Services	1,305	1.6	1.7	8,200	1.1	1.8
Education and Training	1,020	1.2	2.4	12,140	1.6	3.8
Financial and Insurance Services	630	0.8	1.8	7,210	0.9	1.8
Information Media and Telecommunications	535	0.6	1.4	9,130	1.2	3.2
Total	83,910	100	2.8	767,050	100	3.0

Appendix E: Summary Table of Sales by Industry

The table provides an overview of sales in various industries, comparing Māori and non-Māori businesses. It includes sales in million dollars, percentages, and mean sales in thousand dollars. The data is sourced from Stats NZ IDI research dataset produced as part of this exploratory analysis.

Industry	Māori			Non-Māori		
	Sales (\$M)	Percentage	Mean Sales (\$K)	Sales (\$M)	Percentage	Mean Sales (\$K)
Construction	2,765	25.5	383	19,686	18.1	454
Agriculture, Forestry and Fishing	2,236	20.6	405	18,068	16.6	473
Professional, Scientific and Technical Services	1,290	11.9	300	13,000	12.0	289
Retail Trade	810	7.5	687	13,679	12.6	969
Manufacturing	539	5.0	456	8,078	7.4	653
Other Services	513	4.7	308	4,392	4.0	343
Rental, Hiring and Real Estate Services	475	4.4	233	4,779	4.4	240
Transport, Postal and Warehousing	468	4.3	358	3,494	3.2	301
Wholesale Trade	440	4.1	816	7,660	7.1	1,130
Accommodation and Food Services	393	3.6	447	5,187	4.8	537
Health Care and Social Assistance	304	2.8	253	4,392	4.0	278
Administrative and Support Services	296	2.7	212	2,984	2.7	250
Arts and Recreation Services	104	1.0	137	789	0.7	168
Information Media and Telecommunications	90	0.8	232	746	0.7	260
Education and Training	77	0.7	180	860	0.8	267
Financial and Insurance Services	50	0.5	143	829	0.8	206
Total	10,851	100	357	108,623	100	424

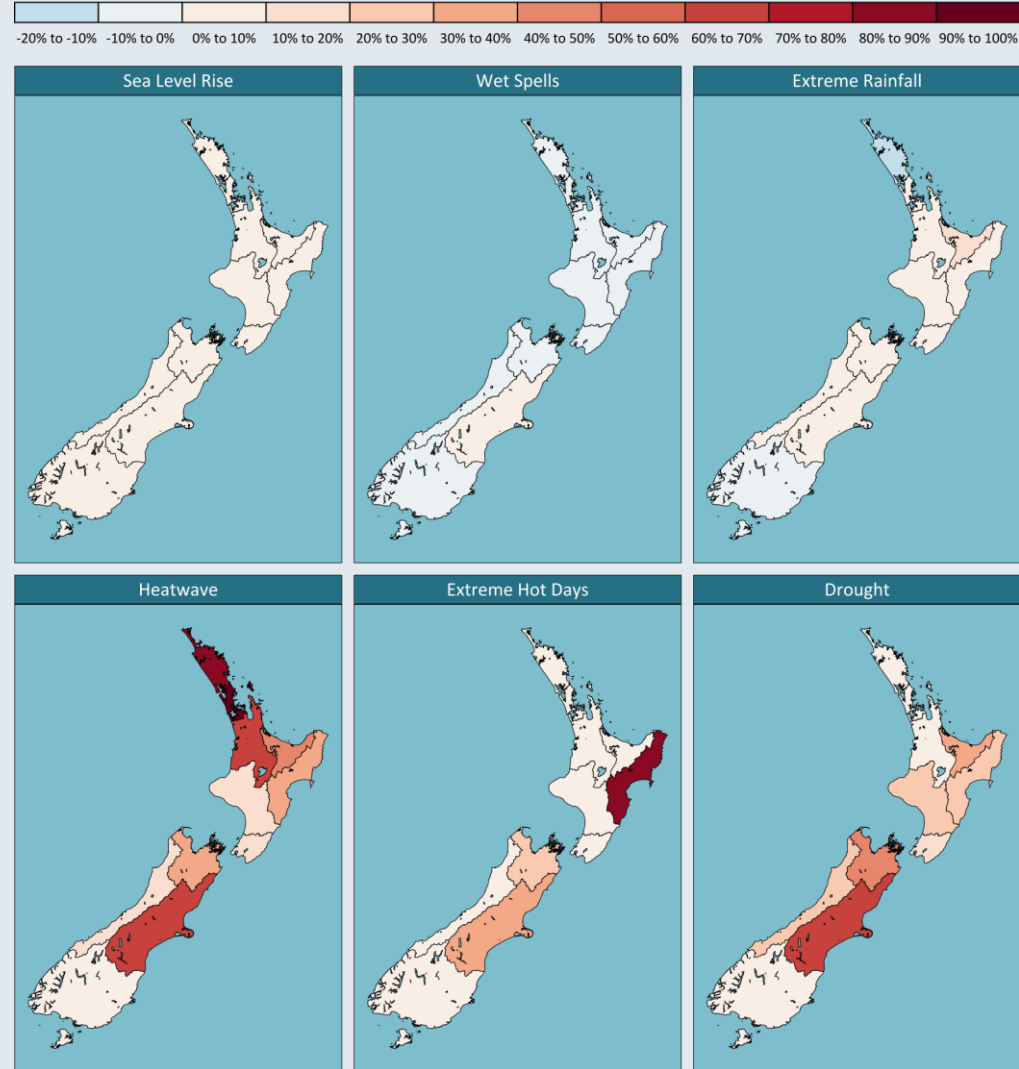
Appendix F: Summary Table of Wages by Industry

The table provides an overview of wages in various industries for both Māori and non-Māori owned businesses. The data includes total wages in million dollars, percentages, and mean wages in thousand dollars. The data is sourced from Stats NZ IDI research dataset produced as part of this exploratory study.

Wages						
Industry	Māori			Non-Māori		
	Wages (\$M)	Percentage	Mean Wages (\$K)	Wages (\$M)	Percentage	Mean Wages (\$K)
Construction	357	27.1	21.4	2,632	19.1	22.2
Agriculture, Forestry and Fishing	219	16.6	13.4	1,561	11.3	14.9
Professional, Scientific and Technical Services	142	10.8	11.6	1,707	12.4	18.0
Other Services	92	7.0	22.1	849	6.2	23.9
Accommodation and Food Services	89	6.8	17.3	1,068	7.8	17.2
Manufacturing	88	6.7	19.3	1,353	9.8	21.0
Retail Trade	85	6.5	14.1	1,440	10.5	17.1
Transport, Postal and Warehousing	62	4.7	18.1	480	3.5	16.1
Health Care and Social Assistance	48	3.6	15.8	580	4.2	15.7
Wholesale Trade	38	2.9	21.3	880	6.4	25.8
Administrative and Support Services	37	2.8	9.0	431	3.1	11.5
Rental, Hiring and Real Estate Services	29	2.2	9.4	283	2.1	10.3
Education and Training	14	1.1	14.0	228	1.7	18.8
Arts and Recreation Services	9	0.7	6.6	82	0.6	10.1
Financial and Insurance Services	5	0.4	8.4	125	0.9	17.3
Information Media and Telecommunications	2	0.2	4.2	76	0.5	8.3
Totals	1,315	100	15.7	13,774	100	18.0

Appendix G: Future vs Baseline Exposure of Climate Hazards to Māori-owned Businesses map

Māori-Owned Business Exposure: Future vs. Baseline





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